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Erratum

The author of the paper on Lavoisier and ether which appeared in the July issue (1953, 7, 318-323) have called the Editor's attention to a mistake occurring in the text. Lines 25-27 on page 323 should read as follows:

Section IV of Chapter VI of Volume II of the *Traité* is devoted to the combustion of ether (pp. 503-506). Plate XII, figure 8, and Plate XI illustrate the apparatus used.

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Benjamin Franklin's Bladder Stone

GEORGE W. CORNER* AND WILLARD E. GOODWIN**

THE Library of the American Philosophical Society has recently come into possession of a series of Franklin documents which give a poignant and highly personal account of the great philosopher's sufferings caused by a stone in the urinary bladder in his latter years. These papers also furnish an illuminating picture of the helplessness of the medical profession, before the invention of lithotrity, in dealing with cases like Franklin's in which operation was inadvisable. Removal of the stone through an incision into the bladder, dreadful and dangerous in pre-anesthetic and pre-antiseptic days even in younger and sturdier people, was precluded by the patient's advanced age. In addition to these personal and technical revelations, we can read between the lines something of the modern striving toward a rational analysis and treatment of disease on the basis of physics and chemistry, which was well under way in the late eighteenth century following the leadership of the iatro-mathematical and iatro-chemical schools of medical thought. In view of these broadly interesting aspects of the subject, we take it for granted that Doctor Franklin, who in his own lifetime was not at all secretive about such personal matters, would not now disapprove the publication of the intimate and distressing details of his illness.

The papers comprise Franklin's own account of his symptoms, submitted to certain eminent British physicians and surgeons, and their letters of counsel sent in reply. To aid in the understanding and appreciation of the correspondence, we begin by giving a brief account of the course of the illness which led to this appeal for advice from the heads of the London medical profession.

The onset of incapacitating urological symptoms occurred at a time when Franklin was busy with diplomatic affairs, and it can therefore be dated rather closely from current events as narrated in Hale and Hale's *Franklin in France* and Van Doren's *Benjamin Franklin*. Previous illnesses, according to a journal of his health kept by Franklin from 1778 to 1780, included "scorbutic symptoms" before 1778 and a severe dermatitis from 1776 to 1788. He

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had repeated attacks of gout beginning at least as early as 1765. William Pepper has carefully documented the record of these attacks. Apparently there was a family history of bladder stone. In a letter of September 6, 1744 to his parents (Smyth, II, 281; Pepper, 20) Franklin discusses the treatment of stone, which had evidently been mentioned among the "ails" his relatives had complained of in their recent letters. They had considered using strong lye as a medicament to dissolve the stone-forming deposit. Benjamin recommended honey and molasses as his contribution to the treatment. These facts will be referred to later in relation to his ideas of medical chemistry and physics.

The sufferer from bladder stone, who was not identified in this letter, was probably Benjamin Franklin's eldest brother John. Eight years later John was definitely afflicted in this way, for there is a well-known letter of December 8, 1752 from Benjamin in Philadelphia to John in Boston (Smyth, III, 103; Pepper, 28; Keyes) in which Benjamin tells how he had designed a flexible silver catheter for his brother and had had it made by a silversmith. This was the first instrument of the kind ever made in America. He goes on to say that for his brother's benefit he had been reading Robert Whytt's article "On the Virtues of Lime Water in the Cure of Stone" (1752) about which he properly gave his brother a very guarded opinion.[1] John had evidently asked for advice on this medicine, and also about the advisability of an operation, but Benjamin said he knew not what to advise: "I can only pray to God to direct you for the best and to grant success." John Franklin was sixty-two years old at the time and had barely three years to live. Thirty years later his distinguished brother was to seek advice for himself on almost identical problems relative to the same disease, namely, whether to take an alkaline drug and whether to risk an operation.

In Benjamin Franklin's case the fact that he had a bladder stone became apparent about the last week of August 1782, when he was seventy-six years old. He had been aware of small urinary calculi earlier, for in writing to David Hartley in September 1782 (Smyth, VIII, 596) he said that he had been "a long time afflicted with gravel and gout." From the history of his activities in these years it is clear that he was able to go about his diplomatic duties, travelling frequently from Passy to Paris, until late August 1782,

[1] Lime water (calcium carbonate solution) is contraindicated in cases of stone because of its high calcium content, which would tend to increase the deposition of calcium calculi in the urinary tract.

when he became seriously ill at a most inconvenient time. The negotiations for peace between Britain and the United States, which were to culminate in the Treaty of Paris signed the next year, were in full swing. The movements of Franklin and the other negotiators can be followed almost from day to day from the records. From correspondence cited by Hale and Hale it appears that he was able to be in Paris at various times up to mid-August, but early in September was ill and confined to his house at Passy. For many weeks thereafter he was unable to attend in person the meetings of the negotiators. In all probability the enlarging bladder stone had set up an inflammatory reaction of serious character, for nothing short of a severe illness could have kept Franklin away from personal service to his country at this critical time.

The course of the ailment during the next three years, up to the time Franklin sought advice from England, can be followed in letters, some of which were conveniently gathered from Smyth's edition of his writings by William Pepper in *The Medical Side of Franklin*. Within eighteen months from the first incapacitating urological illness the condition was chronic and serious. Passages in two letters written from his residence at Passy make this clear. To the Comte de Vergennes he wrote on December 6, 1783, "Being now disabled by the Stone, which in the Easiest Carriage gives me Pain, wounds my bladder, and occasions me to make bloody Urine, I find I can no longer pay my Devoirs personally at Versailles, which I hope will be excused" (Smyth, IX, 124; Pepper, 90); and to John Jay on January 6, 1784, "It is true, as you have heard, that I have the stone, but not that I had thoughts of being cut for it. It is as yet very tolerable. It gives me no pain but when in a Carriage on the Pavement, or when I make some sudden quick movement. If I can prevent its growing larger, which I hope to do by abstemious living and gentle exercise, I can go on pretty comfortably with it to the end of my Journey, which can now be at no great distance. I am chearful, enjoy the company of my Friends, sleep well, have sufficient appetite, and my Stomach performs well its Functions. The latter is very material to the preservation of Health. I therefore take no Drugs lest I should disorder it. You may judge that my Disease is not very grievous, since I am more afraid of the Medicines than of the Malady" (Smyth, IX, 150; Pepper, 92).

By April 1785 Franklin's resolution not to risk disordering his stomach by taking drugs had given way before his growing dis-

comfort. In a letter to Ingenhousz, he writes, "I thank you much for the Postscript regarding my Disorder the Stone. I have taken heretofore, and am now again taking the Remedy you mention, which is called Blackrie's solvent. It is the Soap Lie, with Lime Water, and I believe it may have some effect in diminishing the Symptoms, and preventing the Growth of the Stone, which is all I expect from it. It does not hurt my Appetite; I sleep well, and enjoy my Friends in chearful Conversation as usual . . ." (Smyth, IX, 308; Pepper, 93).

A letter to Benjamin Vaughan in London, a few days earlier, had mentioned receipt of "the other bottle of Blackrie" (Smyth, IX, 57; Pepper, 91). In May he asked his nephew Jonathan Williams to buy for him at Wilkie's, No. 71, Paul's Churchyard, a copy of *Blackrie's Disquisition upon Medicines that Dissolve the Stone* (Smyth, IX, 329; Pepper, 95). Whether or not he ever received this book is not known; no copy of it exists among Franklin's books in the Library of the American Philosophical Society.

The medicament called Blackrie's Lixivium had an odd history. In the early 1760's there was a physician practising in Bath, Chittick by name, who had a private remedy for urinary calculi, which he kept secret by requiring his patients to supply him with veal broth, to which he added his undisclosed active ingredient. Alexander Blackrie (?-1772) a Scottish apothecary at Bromley, Kent, inspired apparently by a combination of altruism and detective curiosity, resolved to identify the drug, which he did by simple chemical tests, finding it to be "a solution of alkaline fixed salts combined with quicklime, or soap lye." Blackrie exposed the secret in a letter to the *Scots Magazine,* October 1763, which he afterward expanded into a volume published in 1766, with a second enlarged edition in 1771. On pages 135 and 136 of the later edition he gives his method of preparation.

"Take eight ounces of pot-ash and four ounces of quick-lime fresh from the kiln; mix and put into a glazed earthen vessel; then pour upon them a quart of boiling soft spring-water; let the infusion remain twenty-four hours, stirring it now and then; and afterwards filtrate it for use."

He adds that he himself substitutes well-calcined salt of tartar for the potash, because it is more uniform. He recommends oyster-shell quicklime. His recommended dosage was from 30 drops twice a day up to two teaspoonfuls thrice a day, in weak veal broth or any other soft mucilaginous vehicle.

The use of a strong alkali was of course not new with Chittick and Blackrie, for we have seen that Franklin was corresponding with his parents on this subject as early as 1744. Doubtless the idea was widespread.[2]

Blackrie's standing with the London medical profession was evidently high, for among the advance subscribers to his 1771 edition listed in the front of the book are such men as Dr. John Fothergill, Dr. George Fordyce, Dr. William Heberden, Dr. William Hunter, Sir John Pringle; and we shall find that Franklin's use of this drastic lye infusion was later approved by his counselors.

We must assume, however, that in spite of the medication his discomfort increased, for in July 1785 his friend Benjamin Vaughan of London received from him an autographic account of his condition. This document was submitted by Vaughan to five of the most eminent physicians and surgeons of London. The original statement in Franklin's hand and copies of a statement by three of the consultants and of letters from the two others were preserved by Vaughan, who evidently kept the original of Franklin's statement after the doctors had seen it, together with the copies of their replies, sending the originals of the latter to Franklin. The correspondence is now made public for the first time in print. Before citing it, something should be said about the persons who took part in this thoughtful consideration of the aged statesman's plight. Benjamin Vaughan (1751-1835) studied medicine at Edinburgh but never practised. After 1781 he was in mercantile business and took also an important part in political affairs as a propagandist for the American colonies. He edited some of Franklin's non-scientific works. One of the two John Hunters who signed the letter of advice needs no identification. This was the great anatomist-physiologist (1728-1793), at that time the leading surgeon of London. His famous portrait by Sir Joshua Reynolds at the Royal College of Surgeons depicts an intensity of reflection and insight which we may imagine him expending upon the problem of the elderly patient, whom he must have known was Franklin. The other John Hunter (?-1809) was also a Scot, a native of Perthshire, who took his M.D. at Edinburgh in 1775. He practised in London after 1783. One of his publications, a paper on the "West Indian Dry Bellyache" caused by lead poisoning was based in part on Franklin's letters on this subject.

[2] The use of drugs to alkalinize the urine is the present approved treatment of patients who tend to form uric acid and xanthine calculi, but strong lye infusions are now never employed.

The identity of names of the two John Hunters has naturally caused confusion in writings on medical history. The two men are for example not distinguished in the text and index of William Pepper's carefully prepared *Medical Side of Benjamin Franklin.* In the documents here presented Benjamin Vaughan correctly docketed the surgeon's name as Mr. J. Hunter, referring to the physician as Dr. Hunter, with the initial I., doubtless standing for Iohannes.

William Heberden (1710-1801), perhaps the foremost of London's physicians at the time, had long been regarded by Franklin as an esteemed friend and fellow-scientist. Heberden, whose name is attached to the deposits occurring in rheumatoid arthritis and gout (Heberden's nodes), should have been a good consultant, for he was the outstanding authority on these conditions, which are probably related to the urinary disturbances underlying stone formation. Doctor (afterwards Sir) William Watson (1715-1787), also a prominent physician, was very well known to Franklin, whose election to the Royal Society it is said he aided. Watson was deeply interested in electricity, on which he wrote important papers. He had been a fellow member with Franklin on a government-appointed committee which in 1772 considered the use of lightning rods on British powder magazines. He was knighted in 1786, a year after Franklin's consultation.

Adair Crawford (1748-1795), physician to St. Thomas's Hospital and professor of chemistry at the Military Academy at Woolwich, was a scientifically-minded student of the problems of heat and combustion in the animal body. His work was well known to Joseph Priestley, who used it in his own cogitations upon the phlogiston theory. Crawford was deeply interested in medical chemistry.

The documents of July 1785 now follow, introduced by Benjamin Vaughan's endorsement on the first sheet. They are published by courtesy of the American Philosophical Society, Philadelphia.

(I)

Opinions of some of the Faculty on the case of
Dr. Franklin; viz Drs. Heberden
Watson
I Hunter Taken July 1785
Crawford &
Mr. J. Hunter

Dr. Franklin's case by himself is inclosed drawn up when in his 79th year.

Case

The Patient is now in his 79th year. When a young Man he was sometimes troubled with gravelly Complaints; But they wore off without the use of any Medecine, and he remained more than Fifty Years free from them.

In the Autumn of 1782, he had a severe Attack accompanied with what was thought to be a Gouty Pain in the Hyp, and down the Thigh of the left Side. Some Means were us'd to bring the suppos'd Gout down into the Foot, by warm Bathing, and a Poultis of Mustard. A swelling was produc'd in the Foot, but not attended with much Pain there; a considerable Pain still continuing above. He daily voided Gravel Stones the Size of small Pease, took now and then some Decoctions of Herbs & Roots that were prescribed him by Friends or Physicians, but persisted constantly in nothing except the Use of Honey at Breakfast instead of or sometimes with Butter on his Bread, he remembering to have heard in the Conversation of Physicians, Honey mentioned as of great Service in Gravelly Cases.

At length the painful Part of the Disorder left him, and no more large Gravel offer'd; but observing Sand constantly in his Urine, he continued the use of the Honey to the Amount of perhaps a Pound per Week; notwithstanding which the Malady return'd in the Autumn of 1783, when he first perceived after going in his Carriage on the Pavement, that he felt Pain & made bloody Water. At times when he was making Water in full Stream, something came and stopt the Passage; this he suspected to be a small Stone, and he suffered pain by the Stoppage. He found however by Experience that he could by laying down on his Side cause the Obstruction to remove and continue the Operation. He now thinks the Stone is grown bigger & heavier as he is sensible of its falling from Side to Side, as he turns in his Bed.

He has made it a Rule for some Months to walk an hour in his Chamber every Night. This Exercise is of service to him in other Respects; but he has observed that if he has emptied his Bladder just before he begins his Walk, the Stone is apt to hurt him, and he makes bloody Water. He therefore of late avoids beginning his Walk, till he supposes the Bladder to be refurnish'd.

His Inclination to make Water is Sometimes very sudden & very violent, tho' the Quantity small.

He feels no Pain, nor is at all sensible of the Existence of the Stone, except when it obstructs his Making Water, or when he is in his Carriage on a Pavement, or on some sudden Motion or Turn of the Body; and he enjoys the Conversation of his Friends or his Books as usual.

Thus if it does not grow worse, it is a *tolerable* Malady, and may be supported for the short time he has a Chance of living. And he would chuse to bear with it rather than have Recourse to dangerous or nauseous Remedies.

If therefore no safe and sure Dissolvent of the Stone is yet known, he wishes to be informed whether there is a Regimen proper to be observ'd for preventing its Increase, as he can without Difficulty conform to any Manner of Living that shall be prescrib'd to him.

In the last attack no large Gravel has offer'd, and much less Sand appear'd in the Urine, whence he suspects that it attaches itself to the Stone. His Urine has however been unusually turbid till lately, when a Fit of the

Gout came on, & swell'd both Feet, since which the Urine has been very clear.[3]

(II)

Copy of an opinion given at a consultation
on the case of Dr. Franklin in the year 1785.

From the History of the Case, and the distinct account of the patient's feelings, we have no doubt that there is a Stone in the Bladder.

Taking into consideration the Time of Life of the Patient, and that the Symptoms are not so urgent as to render Life uncomfortable, we approve much of his resolution not to risk an operation, or any course of Medecine that might endanger his Health. What we shall advise therefore, will be such things as may either prevent an increase of the disease, or palliate the most pressing Symptoms.

As the patient has already taken Blackrie's Lixivium with some advantage; we would advise him to continue it. If it do not offend the Stomack, it may be used for any length of time, Without prejudice to the general health. It has some power as a Solvent, and if that should prove sufficient to prevent the farther increase of the Stone without at all diminishing it, it may procure great relief; For, the painful effects of a stone in the Bladder, do not depend so much upon the size, as the roughness of its Surface, which arises from the constant accretion of new matter. If however, Blackrie's Lixivium should either disagree with the patient, or should cease to produce good effects, there are some other things we would recommend a trial of.

Fixed air[4] has been found to do good in similar cases. The Simplest way of taking it, is to impregnate water with it by means of Dr. Nooth's Machine. Of the Water so impregnated, one or two pints may be drank in the day: or a larger quantity, if it is found not to overload the Stomack. Seltzer water is no unpleasant vehicle of fixed air. To give it a fair trial, it should be persevered in for some time, at least three or four weeks.

The Uva Ursi[5] has been found to give considerable relief in cases of Stone in the Bladder. It is to be taken in the quantity of two Scruples, in half a pint of an infusion of the same, morning and evening. The infusion is to be made by pouring a pint of boiling Water upon three drachms of

[3] The frequent occurrence of turbid urine in persons suffering with bladder stone had long been known and supposed to be somehow causally related to the formation of stones. In the Hippocratic book "On Airs, Waters, and Places" the writer states, "As a proof that it is as I say, persons affected with calculus have very limited urine, because the thickest and foulest part remains and is concreted." In a footnote to his translation of Hippocrates for the Sydenham Society, Francis Adams says: "Theophilus, in his treatise De Urinis, would seem to contradict this observation of Hippocrates, when he states that the urine of calculous persons is thick and milky. But according to Prosper Martian, when the calculus is in the state of formation, its characters are as described by the latter, whereas when the calculus is already formed, the urine is limited, as described by Hippocrates."

It seems likely to us that in Franklin's case the turbidity of the urine was due to infection (which may have aggravated his gout), and that clear urine appeared when the urinary infection subsided.

[4] "Fixed air" is carbon dioxide. This would alkalinize the urine if taken in sufficient quantity and should thus decrease the formation of uric acid concretions.

[5] Uva Ursi: the leaves of Arctostaphylus uva-ursi (bear berry), an astringent and diuretic drug long used in irritative disturbances of the urinary tract. Its beneficial action may be due to acidification of the urine and to subsequent decrease of bacterial growth. If this were so, it would have an opposite effect to carbon dioxide.

the *Uva Ursi*. This Medecine should also be continued some time; at least a month.

We would advise him to guard against costiveness, as that would aggravate his complaints. A teaspoonful of Linitive Electuary, or *Electuarium e Casia*, or a table spoonful of Castor oil, taken from time to time as may be needful, will answer this purpose. The patient may indeed make use of any gentle laxative, that he has found from Experience to agree with him.

We would advise him to avoid as much as possible all rough motion; and to continue his walking in his room. When he finds himself obliged to go abroad in a Carriage, it would be worth trying, how far his pain would be abated, by using the same precaution as in walking, that is, to go with his Bladder full.

If the pain in his bladder, bloody Urine, and a frequent desire to make water, should at any time become troublesome, either from the motion of the Carriage, or other cause, we would advise him to make use of Anodyne Clysters to silence those Symptoms. The Clyster may consist of two ounces of oil, as much water, and forty drops of Laudanum, made milk-warm. It will be proper to throw up a common Clyster, of a pint of water gruel, weak broth, or even warm water, before using the Anodyne Clyster; by this precaution the Anodyne Clyster may be longer retained, and will be more effectual.

In his Diet we would advise the patient to avoid salt meats, spirits of all Kinds, pepper, and every thing that is in the smallest degree heating, as they increase the pain in the bladder, and render it more sensible of any irritation from the Stone. With regard to Wine, we would advise him never to exceed that quantity, that habit may have rendered necessary, for the purposes of digestion.

In Addition to what we have said of the use of anodyne clysters, we would observe, that they may be employed to *prevent* the pain in the bladder as well as to *relieve* it; and that the patient may have recourse to them *before* riding in his Carriage, as a means of lessening his Sufferings; for though we would advise him to avoid every Kind of motion that produces pain in his bladder, yet it may not be always in his power to comply with this Advice.

It is unnecessary to mention particular Articles of Diet; we would only observe that Broths of all Kinds are well suited to the Patient's complaint, particularly white Broths, made with Almonds, which are good both for Diet and physick, being of an opening Nature.

(signed) W. Watson
I. Hunter
John Hunter

(III)

To Dr. John Hunter

Windsor, 18 Jul. 1785

Dear Sir

I was this morning favoured with your letter accompanied with a case and a consultation upon it; all which I have considered, and do not find, that there is anything left for me to say, unless that I entirely agree with you, Dr. Watson, and Mr. Hunter in recommending to the gentleman not to think of an operation at such an advanced age, but to trust wholly to the Lixivium, if he can bear it. I suppose he could find no difficulty in taking a tea spoonful night and morning; and if he could take two, it would be more desirable. Exercise can hardly be wanted for health at the age of 79;

it is high time to lay aside all business, which would oblige a man to go out, and use much motion: I wish therefore your patient would confine himself wholly to his house and garden, and avoid all riding in a Carriage. If this cannot wholly be avoided, and a fit should be brought on by the motion, or by any other cause, the best relief will be afforded by the Anodyne Clyster; and if his body be tolerably regular as to stools, I know of nothing further that his complaints require.

Wm. Heberden

(IV)

Dear Sir

I entirely concur in Opinion with the Physicians whom you have consulted respecting Dr. Franklin's Case that an Operation would not be adviseable.—The Directions which you have already receivd as to the proper mode of Treatment, are so full & Judicious that I think there is little can be added to them. I have the pleasure of sending you Dr. Plunketts Thesis on Mephilic Air.[6]—Tho' his Experiments do not prove that this Air is a Solvent for the Stone yet they seem to shew that drinking freely of Water impregnated with it will have an Influence in retarding the progress of Calculous Complaints.—Whether the Effect is produced by the Water or by the Air may be doubtful. To me it seems probable that it is chiefly to be attributed to the former. And I am the more confirmed in this Opinion because I have found that *Mild Diuretics* are generally useful in Calculous Cases. It is I believe principally owing to its diuretic Quality, that much relief has been had in such Cases by drinking freely of an Infusion of the Seeds of the Wild Carrott. And perhaps the Benefit derived from taking large Quantities of *Lime Water* or from using *Lime Water & Milk* for the common drink, is partly to be attributed to the same Cause. It is not however safe for Patients advanced in Life to drink very freely of Weak Liquids, unless they be at the same time determined to pass off by the Kidneys. With an Intention to promote the Urinary discharge & alleviate the Symptoms when the irritation is most troublesome, I generally prescribe mild diuretics joined with an Anodyne & a gentle Laxative in the following form[7]

Rx

Aq. pur. ℥ vj
Muc. Gum. Arab. ℥ ij
Nit. Pur.
Spirit. Nit. dulc. ā ℥ ij
Manna opt. ℥ iss̄
Tinct. Theb. gtt. xx ad x c

Capt. Coch. ij ter de die ex Cyatho. Infusi Lini.

The manna in this prescription should be increased or diminished until its quantity is found to be such as will be just sufficient to keep the Bowels gently open; & the Dose of the Laudanum should be regulated according to the Degree of Pain or the Effect of Custom upon the Constitution—I am etc.

Signed
Adair Crawford

London Street 22 July 1785

[6] "Mephitic air" (here incorrectly written *mephilic*) is carbon dioxide.

[7] The prescription included a mucilaginous substance (gum arabic), a diuretic (potassium nitrate), a laxative (manna), and opium (Tinctura thebaica), to be taken in a wineglassful of linseed infusion.

(V)

Farther Remarks by Dr. Crawford

The Symptoms of the Stone in the Bladder are as follows.

A frequent inclination to make urine, which is passed with pain difficulty. Tenesmus (or a desire to go Stool) accompanied sometimes with a diarrhea, & distension & pain in the Region of the Colon: (that is, of the great intestine, which makes a circular arch below the Liver & Stomach & is principally situated in the left side of the Abdomen.) A sense of titillation in the glans penis. Thick turbid urine. Spasmodic affections in making water. The urine, after exercise, tinged with blood. Greater facility in making water when the body is placed in particular positions. The urine when it is passing in a full stream, sometimes suddenly stopped. A sense of weight in the Perineum.

When a stone is passing from the kidney to the bladder by one of the ureters, the pain is increased, & tends downwards. The patient is easiest, when stooping forwards. The Leg & Thigh become torpid. The urine is partly suppressed.—A fit of the stone, when the pain is very great, is sometimes accompanied with a symptomatic fever.—The mode of treatment proper *during the fit,* is different from what it should be when the patient is free from it. In the former case, the object is to diminish irritation by gentle laxatives, fomentations applied to the Perineum, emollient decoctions, opiates, & Rest.

During the remission, the object is to dissolve the stone, or render its surface smooth by lithontriptics, as caustic alkali Soap, Lime water, diuretics. But these should not be exhibited at the time of the paroxysm, as by their stimulating quality they might increase the irritation. Nitre & Spiritus Nitridulus, are I think an exception to this rule; because if properly administer'd they do not appear to me to irritate, even when the patient is afflicted with the fit.

The following are the principal authors who have written on the stone in the bladder.[8]

Tulpii observations med. Lib. 4, Caput 37
Forestus Lib. 25. observat 23.
Fabricius Hildanus Cent 3 Observ. 67.
Car. Pisonis de Morbis a Golluvie serosa
Bonet. Sepulchret. de urin. Suppress. observ. 10
Sydenham
Lob—Edinburgh medical essays—vol. 4
Whytt

Two items in the treatment of this case are worth comment. Franklin's own prescription of honey, molasses, and jellies with the idea that they would increase the specific gravity of the urine and thus buoy up the stone-forming deposits and prevent them from becoming aggregated is an interesting even though mistaken application of physics to medicine. The advance of physical science in the seventeenth century had broken down the ancient

[8] Dr. Crawford might also have cited Hippocrates, Celsus, Paul of Aegina, and other ancient writers who described the symptoms of bladder stone in almost the same terms as those he used.

humoral pathology and had begun to supply a new basis for understanding diseases. Two schools, the iatro-mathematical and the iatro-chemical, had grown up in the century preceding Franklin's time, the former of which attempted to explain all physiological phenomena as resulting from the operations of physics, the latter as the outcome of chemical reactions. Franklin's idea about increasing the buoyancy of the urine was an application of iatro-mathematical thought.

No doubt Franklin had in mind also the simpler notions that sirupy liquids might have a soothing effect upon the irritated bladder lining, and by their viscosity assist the passage of gravelly concretions or mollify the rasping of a stone. He could not have known of the homeostatic powers of the body, by which the specific gravity of the urine and other body fluids is held within a very narrow range, nor that the sugars of the honey and jellies he took were restrained from passing through the kidneys and were rapidly destroyed by the digestive processes.

The proposal to dissolve the stone-forming deposits by the use of a drastic solvent, e.g., the alkali in such a drug as Blackrie's Lixivium, is on the other hand an example of iatro-chemical thinking. It is not clear whether Franklin and his advisers had any hope that the stone, once formed, might be dissolved by the alkaline agent acting in the urine. Their concern about the dose of Blackrie's Lixivium the patient could tolerate shows their awareness that the strong alkali might attack the patient's tissues more effectively than the relatively insoluble stone. There is of course good sense in the idea that the formation of a stone might be delayed, or its growth retarded, if the chemical substances that form it could be kept in solution in the urine and thus voided without precipitation; but these men could at the time have no clear idea of the variable and often mixed chemical nature of urinary calculi, nor of the complex problem involved in altering the chemical reaction of the urine by administration of alkalis and acids. Medical science was at this very time beginning to be re-erected upon foundations of physics and chemistry, but in 1785 neither the great philosopher nor his eminent advisers were in a position to make anything but premature clinical applications of the new ways of thinking about physiology and pathology, at least in so grave and difficult a case as this.

On July 12, 1785, while the London doctors were considering his case, Franklin left Passy on his way home to America. In a

journal kept at this time (Smyth X, 464-471) he noted that "the motion of the litter, lent me by the Duke of Coigny, did not much incommode me. It was one of the Queen's, carried by two very large mules, the muleteer riding another." He sailed from Le Havre on July 22 and arrived at Philadelphia September 14. However uncomfortable he was, he was cheerful and very active mentally. As Van Doren points out, he wrote more on scientific matters that August while at sea than in any other month of his life.

In spite of good advice and a sensible regime, however, Franklin's condition did not improve. In a letter to Le Veillard, April 15, 1787 (Smyth IX, 560; Pepper, 107) he wrote that he was conscious that the stone had grown heavier, but sitting temperately in bed he was generally quite easy. A few days later, writing to Le Roy (Smyth IX, 572; Pepper, 107) he said "I had sometimes wished I had brought from France a balloon sufficiently large to raise me from the ground. In my malady it would have been the most easy carriage for me, being led by a string held by a man walking on the ground." To Buffon, the great naturalist, who was also afflicted by the stone, he wrote November 19, 1787 (Smyth IX, 622; Pepper, 107):

> As the Roughness of the Stone lacerates a little the Neck of the Bladder, I find, that when the Urine happens to be sharp, I have much Pain in making Water and frequent Urgencies. For Relief under the circumstances, I take, going to Bed, the Bigness of the Pigeon's Egg of Jelly of Blackberries. The Receipt for making it is enclosed. While I continue to do this every Night, I am generally easy the day following, making Water pretty frequently, and with long intervals. I wish most sincerely that this simple Remedy may have the same happy Effect with you. Perhaps Current Jelly, or the Jelly of Apples or Raspberries, may be equally serviceable; for I suspect the Virtue of this jelly may be Principally in the boiled Sugar, which is in some degree candied by the Boiling of the Jelly. . . .

During these years of advancing age and increasing illness Franklin was by no means inactive, though he never left Philadelphia. He had been elected President of the Council of Pennsylvania immediately after his return to America, in September 1785; and he held this post for three years, attending meetings occasionally as his health permitted. He took an active part in the Constitutional Convention of 1787. In the same year he supervised the erection of five houses. He kept up an extensive correspondence with friends in Europe and America, worked on his Autobiography, and wrote various philanthropic and political papers.

By the summer of 1789, however, his resistance to pain was breaking down and he was having to take opium. He was now in his eighty-fourth year. To Le Veillard he wrote, September 5 of this year (Smyth X, 35; Pepper, 110):

> I hope . . . that you now enjoy perfect Health; as to mine I can give you no good account. I have a long time been afflicted with almost constant and grievous Pain, to combat which I have been obliged to have recourse to Opium, which indeed has afforded me some Ease from time to time, but then it has taken away my Appetite and so impeded my Digestion that I am become totally emaciated, and little remains of me but a Skeleton covered with a Skin. . . .

Two months later the situation was worse, as Franklin wrote November 2 (Smyth X, 49; Pepper, 110) to Benjamin Vaughan, who had taken so much interest in the case:

> I thank you much for your intimations of the virtues of hemlock, but I have tried so many things with so little effect, that I am quite discouraged, and have no longer any faith in remedies for the stone. The palliating system is what I am now fixed in. Opium gives me ease when I am attacked by pain, and by the use of it I make life at least tolerable. Not being able, however, to bear sitting to write, I now make use of the hand of one of my grandsons, dictating to him from my bed.

When Benjamin Franklin's optimism had left him, the end could not be far off. Yet there were still interludes of relative comfort. Thomas Jefferson saw him in early April 1790, and wrote to Le Veillard:

> I wish I could add to your happiness by giving you a favourable account of the good old Doctor. I found him in bed where he remains almost constantly. He had been clear of pain for some days and was cheerful and in good spirits. He listened with a glow of interest to the details of your revolution and of his friends which I gave him. He is much emaciated. I pressed him to continue the narration of his life and perhaps he will. (Smyth X, 488).

The long torment was finished two weeks later by his death on April 17, 1790 at the age of eighty-four years and three months.

UROLOGICAL CONSULTATION, 1953

The 1785 consultation note of W. Watson, I. Hunter, and John Hunter is correct for that day and to the point. There is actually very little to add to the epitome of their first two paragraphs ". . . we have no doubt that there is a stone in the bladder"; and ". . . we approve much of his resolution not to risk an operation. . . ." From the vantage point, however, of a century and a half

later, it is entertaining to speculate a little concerning Franklin's illness.

The history is a clear and remarkably exact description of a classical case of bladder stone. One wonders about the contributory factors. On the first page of this manuscript we learn that Franklin suffered "scorbutic symptoms" and dermatitis from 1776 to 1788. Vitamin A deficiency is a common cause of dermatitis, and there is experimental evidence to show that avitaminosis A contributes to the formation of renal calculi. It is also stated that there was a family history of bladder stone. Urinary calculi are often considered a familial disease due either to hereditary or geographical factors.

It is of particular interest to consider the likelihood that the primary defect was metabolic, related to his gout, and that the stones he passed when he was "a long time afflicted with gravel and "gout" were multiple uric acid calculi.[9] If this were so, continuous alkalinization of the urine would have prevented them.

Another interesting metabolic disease that would be consistent with Franklin's story is hyperparathyroidism. In this condition a functioning tumor of one of the parathyroid glands develops and causes a profound dislocation of calcium metabolism. The bones become demineralized, and blood calcium rises to pathological levels. The resulting increase in urine calcium excretion predisposes to formation of urinary calculi, which are often multiple and recurrent. The treatment of this disease is surgical removal of the stones and of the parathyroid tumor, neither of which would have been feasible in Franklin's time even if the diagnosis could have been made. In the personal experience of one of us, a twentieth century patient suffering from bladder stone had symptoms almost identical to those described by Franklin except that his greatest agony was occasioned by overnight travel in a Pullman car instead of a horse-drawn carriage. After surgical removal of his stone, the diagnosis of hyperparathyroidism was confirmed by consistent findings of high calcium levels in the blood serum. At the present day the differentiation between this disease and gout with uric acid calculi would be made by careful study of blood calcium and uric acid levels, tests impossible in Franklin's day. Such an explanation of his illness is intriguing; but it seems more likely, in studying his history as a whole, that the multiple calculi were due to gout and the related disorder of uric acid metabolism.[9]

[9] For recent discussions of the association between gout and urinary calculus, see the articles by Kittredge and Downs, and Modern and Meister, cited in the references.

The urologist commonly sees old men with a history of youthful indiscretions and subsequent chronic inflammatory contraction or bar formation at the bladder neck. One might speculate on the likelihood of the following train of events in this case (see the first page of his own case history). He had a "gouty diathesis" and passed multiple uric acid calculi in his youth. In the autumn of 1782 the severe hip pain, interpreted as "gouty," was in fact probably due to an unusually large calculus in transit from the left kidney down the ureter. When it finally entered the bladder, "the painful part of the disorder left him," and other smaller stones, which had formed and impacted above it, passed in great numbers. One stone, however, must have been larger than the "Gravel Stones the Size of small Pease," which he had previously voided. It would not pass out of the bladder, perhaps because of inflammatory contracture of the vesical neck, or perhaps because of prostatic hypertrophy and subsequent obstruction. The rest of the gravel, which had been in the ureter behind the large stone, passed easily. Then there was only sandy urine as the now retained bladder stone began to grow larger. The bladder stone, which was perhaps the size of a large pea in the autumn of 1782, grew larger and larger until a year later, when it must have been about the size of a pigeon's egg, he first "felt pain and made bloody water" after "going in his carriage on the pavement." His description of stoppage of urination "in full stream" in the autumn of 1783 is typical of this situation.

It was at this time (two years before he sought medical consultation from his friends in England) that he might have been a candidate for surgical treatment. Perineal lithotomy, one of the most ancient of operations, had been greatly refined from the crude but accepted operation described by Celsus and all after him. There were good lithotomists in France and England at that time; and the improved perineal lithotomy of Marianus ("method of the great apparatus") in which a grooved sound and gorget were used, was generally practised (Sanford; Twinem and Langdon). The operation was heroic in pre-anesthetic days and was usually done only on young men. More than a hundred years before Franklin's illness, another great autobiographical writer, Samuel Pepys, underwent successful perineal lithotomy at the age of twenty-six with great relief of symptoms (Dale; Pepys; Power). Suprapubic cystolithotomy was also occasionally done at that time, though it carried a frightfully high mortality even up to the end of the

nineteenth century. Crushing of bladder calculi (lithotrity), though described since antiquity and successfully employed by Italian lithotomists in the seventeenth century, was not in general use in 1783, and it was not until 1824 that the great French lithotomist Civiale inaugurated the crushing of bladder calculi as practised in our era. It was nearly a hundred years after Franklin's illness before his distinguished fellow countryman, Bigelow, published his method of "litholopaxy," transurethral crushing and evacuation of bladder calculi which is used to this day. In Bigelow's time the mortality from perineal lithotomy was 20 to 23 per cent, and from lithotrity 15 to 23 per cent in patients over fifty. His litholopaxy had a mortality of only 2.4 per cent and is especially suited to poor operative risks.

If Franklin had been subjected to surgery, he would probably have had to choose between suprapubic lithotomy with its danger of peritonitis and perineal lithotomy with its dangers of hemorrhage and perineal trauma. The mortality rate probably ranged from 25 to 50 per cent, and would no doubt be much higher for a man nearing the eighties. The operation would have been done without anesthesia. Even had Franklin desired it, it seems unlikely that any surgeon of that time would have dared to undertake such an operation on a man of his years.

In 1785 Franklin's decision and the advice of his consultants against surgery followed the only reasonable course. Today he would be safely and painlessly cured in less than an hour by either open suprapubic cystolithotomy or Bigelow's litholopaxy.

What then of the other advice concerning "such things as may either prevent an increase of the disease or palliate the most pressing symptoms"? He had the best advice of the outstanding men in London, yet probably the only suggestions of real value were those concerning the use of opiates and the advice to walk with his bladder full, to keep his bowels open, to force fluids, and to use anodyne enemas. His own ingenious thought, "I had sometimes wished I had brought from France, a balloon sufficiently large to raise me from the ground. In my malady it would have been the most easy carriage for me, being led by a string held by a man walking on the ground," might appeal as symptomatic treatment to some present-day sufferers from bladder stone. The search for effective lithontriptics to be taken orally still goes on to this day. Present researches on enzyme chemistry and colloidal chemistry of the urine are aimed in this direction. There are even now no known

solvents for stones that can be administered orally, except in very special cases. It is true that small uric acid and cystine calculi may disappear or decrease in size in an alkaline urine, and possibly Blackrie's Lixivium and carbonated water helped in this way if his stone was, as we have supposed, predominantly of uric acid. The use of these remedies may account for the fact that after a time his urine became more clear. It is likely, however, that a large bladder stone, even if its original matrix was of uric acid, would have become sufficiently coated with calcium and phosphate layers to make it impervious to anything that could be taken orally. The advice to take large quantities of fluids was sound. It has been demonstrated experimentally in animals that formation of bladder calculi may be prevented or minimized by large fluid intake.

At present it is possible, in certain selected cases, to dissolve or decrease some urinary calculi by direct irrigations with buffered, non-irritating acid solutions. In the personal experience of one of us a small bladder stone was dissolved in this way by continuous tidal irrigations when operation was considered too hazardous for the patient in question. This seems a logical and simple mechanical-physicochemical step, and one that the inventive Franklin might have considered himself. The effective use of such treatment is, however, a development of the twentieth century.

The stone probably enlarged until it occupied most of the bladder, weighing as much as 400 or 500 grams (cf. Twinem and Langdon). The kidneys must have been damaged, and it is not unlikely that a uremic condition may have contributed to Franklin's death, which was primarily due to empyema.

He got along, on the whole, remarkably well with his growing torment during the eight years he was troubled with it. His condition was well managed under the circumstances. The doctors gave him good advice. His own remarks to his brother thirty years earlier were appropriate to his own illness: "I can only pray to God to direct you for the best and to grant success."

REFERENCES CITED

BLACKRIE, ALEXANDER. *A disquisition on medicines that dissolve the stone. In which Dr. Chittick's secret is considered and discovered.* London, 1766.

———— The same. In two parts. London, 1771.

CELSUS. *De medicina,* Book VII, 26.

DALE, PHILIP M. *Samuel Pepys.* Norman, Oklahoma, 1952.

FRANKLIN, BENJAMIN. "Notes on his health." This brief journal was printed by Hale and Hale (q.v. in this bibliography) I, 246-250; in the *Complete Works* edited by John Bigelow, New York, 1887-1889; and in *Benjamin Franklin's Autobiographical Writings,* edited by Carl Van Doren, New York, 1945.

HALE, E. E. AND HALE, E. E., JR. *Franklin in France.* Boston, 1887-1888. 2 vols.

KEYES, E. L. A letter on catheters written by Benjamin Franklin to his brother John, with a comment by Edward Loughborough Keyes. Fulton, New York, privately printed, 1934.

KITTREDGE, W. E. AND DOWNS, RALPH. The role of gout in the formation of urinary calculi. *J. Urol.*, 1952, *67*, 841.

MODERN, F. W. S. AND MEISTER, LESTER. The kidney of gout, a clinical entity. *Med. Clin. N. America*, July 1952, p. 941.

PEPPER, WILLIAM. *The medical side of Benjamin Franklin.* Philadelphia, 1911.

PEPYS, SAMUEL. *Diary.* London, 1893. *Passim*, especially the entry for March 26, 1660, and note on vol. I, p. 1 of Wheatley's edition.

POWER, Sir D'ARCY. The medical history of Mr. and Mrs. Samuel Pepys. *Lancet*, 1895, *1*, 1357.

SANFORD, HENRY L. An historical sketch of the surgical treatment of vesical calculus. *J. Urol.*, 1924, *11*, 111.

SMYTH, A. H. *The writings of Benjamin Franklin.* New York, 1905-1907. 10 vols.

TWINEM, F. P. AND LANGDON, B. B. Surgical management of bladder stone. *J. Urol.*, 1951, *66*, 201.

VAN DOREN, CARL. *Benjamin Franklin.* New York, 1945.

The Complementary Careers of Michael Servetus: Theologian and Physician*

CHARLES D. O'MALLEY**

ON this day, the 11th of April, four hundred years ago, Michael Servetus[1] was in hiding somewhere in France. He had escaped from prison in Vienne several days earlier and was a fugitive from the inquisition and its temporal arm, the police. For some eighteen weeks his whereabouts was unknown until he determined to pass to Italy by way of Geneva and unwisely appeared in that city on a Sunday which made church attendance necessary. He was recognized, and thereafter on 27 October 1553, that arch-inquisitor John Calvin, *le pape de Genève*, made good his determination voiced some six years earlier, that if Servetus were to come to Geneva, and if it were in Calvin's power, he would never depart alive.[2]

Among our self-righteous forebears it was frequently the fashion to attach to the condemned man some indication or symbol of his crime, and in the case of Servetus, chained to the stake and about to be burned alive, a copy of his recently printed *Christianismi restitutio* was fastened to his leg. To Calvin it symbolized the heresies of the condemned man and Calvin's determination that they should be destroyed. That the book also contained the first printed description of the pulmonary circulation meant nothing to him. As a lawyer and theologian he would not have understood it, and as a believer in predestination and himself as one of "the choice elected few"[3] it was of little consequence anyway. As a matter of fact, the entire edition of one thousand copies of the book was tracked down and almost completely de-

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1 At present the soundest biographical study of Servetus is that by Earl Morse Wilbur, *A history of Unitarianism* (Cambridge, Mass., 1945), pp. 49-75, 113-85. A full-scale monograph by Roland H. Bainton, *Hunted heretics, life and death of Michael Servetus*, will appear shortly.

2 Calvin to Guillaume Farel Feb. 13, 1546/47: *Nam si [Servetus] venerit [ad Genevam], modo valeat mea auctoritas, vivum exire numquam patiar. Calvini opera*, 1874, XII, 283.

3 We are the choice elected few,
Let all the rest be damned;
There's room enough in hell for you,
We won't have heaven crammed.

stroyed so that to our knowledge only three copies have survived,[4] but sufficient to gain for the author a recognition denied him in his own day. Thus the book which went with Servetus to his destruction and symbolized for Calvin the end of both the heretic and his heresies has, on the contrary, revived the name of the victim and for many has gained him a brighter place in history than that of his executioner. Finally, the fact that this first account of the pulmonary circulation is imbedded in a theological work is in the case of Servetus no cause for amazement, as I hope to indicate.

Servetus was born in Spain about 1511 and in due course, although precisely where we don't know, received instruction in Latin and Greek; possibly also he gained a smattering of Hebrew and, with still less likelihood, some knowledge of Arabic. About 1526 he left the provincialism of Spain for Toulouse where for a time he studied law. He was to remark later, and perhaps unjustly, that the Spaniards are "of happy wit but imperfect learning so that you will find a learned Spaniard anywhere rather than in Spain itself. They believe themselves learned when they are half-taught, and by pretense and a kind of verbosity they display a greater knowledge than they actually possess."[5] On the other hand, France was the home of learning: "Toulouse is the mother of those skilled in law. . . . But most famous of all is Paris at which gather almost all Christians of Europe for the study of theology, philosophy and other liberal arts."[6] Thus by crossing the Pyrenees Servetus had entered, or at least thought he had entered, the mainstream of civilization and learning.

It was just at this time that new guides were being proposed for two of the major disciplines: the Bible as the expositor of divine learning, and the purified Greek text of Galen, or the new and accurate Latin translations of it, as the true source of medical knowledge. A literal mind and a knowledge of Greek and Latin could produce a theologian or a physician, and Servetus sought to become both. He read the Bible for the first time during his student days at Toulouse and so began his theological career.

A trip to Bologna in the imperial train for the coronation of Charles V permitted him to see something of the sophistication of the papacy under the Medici pope Clement VII. Like Martin

[4] On this and all other matters of bibliography see the forthcoming bio-bibliography of Servetus by John F. Fulton, *Michael Servetus. Humanist and martyr* (New York, Herbert Reichner, 1953).

[5] *Claudii Ptolemaei . . . Geographicae enarrationis libri octo. . . . a Michaele Villanovano . . . recogniti* (Lugduni, 1535), "Hispania."

[6] *Ibidem*, "Gallia."

Luther, another young provincial, Servetus was shocked and dismayed by what he saw and what he fancied. He appears already at the ripe age of eighteen to have determined upon the future course of Christianity, that is, a simplification in accordance with his reading of the Bible, and more likely of success in the areas of the new churches.

Hence we next find Servetus seeking to persuade Zwinglian and Lutheran divines that the doctrine of the Trinity needed simplification and that the Lutherans were in error in denying the value of good works. Servetus was sincere, but he was also regrettably zealous and dogmatic, and when the theologians remained unmoved, he sought to appeal to the faithful over the heads of the authorities in two little tracts which he published in 1531 and 1532.[7] The result was to produce in Servetus one of his rare instances of discretion and the decision to flee from the unsympathetic lands of protestantism.

We next find him in the great French publishing centre of Lyons,[8] but under a pseudonym, and for the next twenty-one years Servetus was known as Michael Villanovanus, a reference to the Villanueva in Spain where he had spent his early youth. In Lyons he entered upon his medical and scientific career.

A man with sufficient classical education could usually gain employment in one of the printing and publishing houses in Lyons, and Servetus appears to have worked as a corrector for the brothers Gaspard and Melchior Trechsel. It seems likely that in the course of his work he must have been required to read the proofs of various medical writings and, of course, the several works of Galen which the press published. Thus as he had previously been initiated into the sacred canon of the Scriptures, so now he was imbued with the sacred canon of medicine, as he later calls it "the traditional authority of Galen." Another source of his interest in medicine may have been the celebrated physician of Lyons, Symphorien Champier; this we have on the word of Servetus who terms himself a student, or disciple, of Champier,[9] a phrase which could mean much or little.

[7] *De Trinitatis erroribus libri septem* ([Hagenau], 1531). *Dialogorum de Trinitate libri duo* ([Hagenau], 1532).

[8] In the course of his interrogation in Geneva, 1553, Servetus remarked of himself: *De Agnouw il sen retournit à Basle, de Basle à Lyon, là out il demorit envyron 2 ou 3 ans.* *Calvini opera*, 1870, VIII, 767.

[9] *Apologia in Leonardum Fuchsium* (Lugduni, 1536), "Preface."

At his trial in 1553 Servetus remarked that he had studied at the Collège de Calvi[10] in Paris. Presumably this was in 1534, and his interest seems to have been in mathematics, possibly as preparation for the edition of Ptolemy's Geography which he was to edit in the following year. Possibly, too, his medical interest was not so strong that it could not be deflected by other disciplines, and perhaps Servetus with a publisher's advance was already at work on the Ptolemy. At any rate, the publication of the Ptolemy in 1535 represents the second most important original contribution of Servetus, now about twenty-four years old. His original accounts of European nationalities, his contrast between Spaniard and Frenchman, hold a significant place in the history of comparative geography and ethnography; and there is a single, notable, medical reference in his flat denial of any healing power in the royal touch of the kings of France.[11]

Having returned to Lyons for the publication of the Ptolemy, by November 1536 he was once again in Paris, as is indicated by the preface to his next work, a brief polemic directed against Leonard Fuchs, the later celebrated physician and botanist of Tübingen.[12] Just at this period the new school of Galenists was rising to combat the older, and as Servetus termed them, "forces of the Arabs" and the "sordid corruptions of the barbarians." As the Galenists were a new force, so they were also enthusiastic and impetuous. Friends were at first not easily distinguished from foes, and frequently Galenist belabored Galenist, which apparently did not matter much since they all seemed to enjoy controversy anyway. So it was that Fuchs and Symphorien Champier became embroiled in a dispute over a question on which, as it turned out, they were in agreement, that is, whether syphilis was a new disease or an ancient Greek one called *lichen*. It was on behalf of Champier that Servetus now published his *Apologia* against Fuchs to which

10 . . . *et de là s'en vint à Paris et demeura au College de Calvi quelque temps. Calvini opera*, VIII, 846.

11 "I myself have seen the king touch many attacked by this ailment but I have never seen any cured." *Ptolemaei geographicae libri octo* (1535), "Gallia." For an evaluation of Servetus as a geographer, see Eloy Bullón y Fernández, *Miguel Servet y la geografía del renacimiento* (Madrid, 1929). There will soon appear a translation of Servetus' contributions to Ptolemy's Geography as well as the other non-theological writings by the present writer: *Michael Servetus. A translation of his geographical, medical and astrological writings*, to be published as Vol. 34 of the Memoirs of the American Philosophical Society.

12 On the general controversy and the feud between Fuchs and Champier to which Servetus contributed his *Apologia* see Eberhard Stübler, *Leonhart Fuchs* (München, 1928).

no reply was ever issued.[12a] Fuchs, it may be said, was already at that time carrying on three other controversies.

This little polemic is interesting because Servetus first begins by attacking Fuchs' theology—denial of the value of good works—and only thereafter does he concern himself with the medical question. Thus here as in his final work Servetus displays both interests, theology and medicine. As far as the medical aspects of the tract are concerned, it is apparent that he was as literal a Galenist as he was a biblicist and that he, too, found considerable satisfaction in controversy.

During the following year, 1537, Servetus remained in Paris apparently engaged in private studies most likely of a mathematical character. There is, however, evidence that he was probably reading also in the classical medical writers, but as yet there was no evidence that he had undertaken any formal training in the medical school of the University of Paris. A remark in his next publication, the *Syrups,* suggests that he had established a personal acquaintance with Jacobus Sylvius of the medical faculty,[13] and it may be that he had as an auditor attended some of the lectures of Sylvius as well as those of Guinther of Andernach, another distinguished member of the faculty. However, a second statement in the *Syrups* suggests that he had no personal acquaintance as yet with the latter professor.[14]

The year 1537 witnessed the publication of the book *On Syrups* which has just been mentioned, his longest strictly medical publication of perhaps 30,000 words. It was to enjoy a certain degree of success, indicated by five editions.[15]

The *Syrups* is concerned with both Galenical physiology and therapy. It is literal Galenism to the degree that philology very

[12a] Nevertheless, Fuchs was stung by the assertion that he stuffed his writings needlessly with both Greek texts and their Latin translations. In his defence of his practice there is the suggestion that he was aware of the attack of Servetus or, as he naturally calls him, Villanovanus, "The fact that I have always added the Latin [translation] to the Greek text was not that the *Paradoxes* might be increased in size, as Montuus considers somewhat maliciously, but that they might be equally intelligible to all: that is, for those who take greater pleasure in the Greek than in the Latin as well as for those to whom the former language is completely unknown. For I do not see what benefit might be gained from a reading of the Paradoxes by those who cannot follow the Greek [alone]. . . . I did not labor especially that my plan should please Montuus and Villanovanus." *Apologia adversus aliquot palam insanas et convitiis plenas Sebastiani Montui dialexeis,* in Fuchs' *Libri IIII difficilium aliquot quaestionum* (Basel, 1540), p. 135.

[13] "When this opinion of mine was asked, that incomparable preceptor of sounder medicine, Jacobus Sylvius, a man endowed with a sharp judgment and highly skilled in interpreting Galen, did not disapprove it." *Syruporum universa ratio* (Paris, 1537), f.61a.

[14] ". . . and that very careful restorer of Galen and praiseworthy physician Guinther of Andernach, when he lectured publicly at Paris on the Greek text of Galen, considered that this place ought to be emended." *Ibidem,* f.68a.

[15] Paris, 1537, Venice, 1545, Lyons, 1546, 1547, 1548.

largely takes the place of medical experience and the whole work bears the stamp of the library rather than that of the clinic. Servetus considers first the actions by which ingested food is concocted or digested in the stomach and thereafter the process by which the nutritive portions of this food, carried thence in the blood, are selected and absorbed by the various parts of the body. Under certain conditions of bodily distemper such nutriment may fail to be absorbed and may degenerate and produce perhaps a putrid condition, perhaps some imbalance of the humors. This, in turn, brings forward the question of therapy and the consideration of syrups, or, as Servetus defines them, sweetened potions prepared to assist in breaking up or extenuating any obstruction of humors in the blood. The Arabists are strongly attacked, notably Avicenna, for a too great employment of such things and for regarding them as purges; on the other hand, Servetus as a follower of Galen and Hippocrates, advocates milder measures, particularly the recognition of the recuperative power of the body which should be assisted rather than violated. "In this little book," Servetus writes, "I explain the maturation of diseases, the action of the concocting power, the true function of syrups and how they ought to be employed, a novelty, as it were, resurrected out of an old dogma. . . . I call upon Galen by whose judgment, as the traditional authority, I have sought to direct this whole treatise on syrups."[16] It may be added that the book demonstrates not only a considerable knowledge of Galen and Hippocrates but a very literal reading of those texts as well.

While the *Syrups* is a first-class résumé of certain aspects of Galenical physiology, it may be added, although with considerable trepidation, that the book may have had another and far more important result upon its author. For Servetus the vehicle of bodily nourishment was the blood which carried nutriment to successive parts of the body, each in turn taking what it required and passing on the surplus as refuse or excrement. While this refuse might be harmless, occasionally it might produce a dangerous condition of humoral imbalance or putridity in some part which must then be evacuated. There is no mention of the ebb and flow of the blood, nor is there any mention of a circulation, although the idea of circulation in some instances would be more logical. This, of course, is a dangerous hypothesis since it represents the post-Harveian point of view. Nevertheless, it is interesting to note that in one in-

[16] f.2b.

stance Servetus quotes from Galen: "In tertians the bile is strongly moved, and is disseminated through the separate parts of the body, and by its driving force it is expurgated by itself," and for "driving force" the Spanish translator of the *Syrups,* presumably from his reading of the context, employs the word "circulation."[17] This is certainly stretching a long bow, but the possibility that the initial germ of the idea of the circulation is to be found in this *Syrups,* remote as it may seem, cannot be completely denied.

In March 1538, according to our present reckoning of time, Servetus finally enrolled in the medical school of the University of Paris.[18] In his later interrogation in Geneva he mentioned as his teachers Sylvius, Fernel, and Guenther of Andernach.[19] This last named professor was later to claim Servetus as his student in the introduction to the 1539 edition of his *Anatomicae institutiones* in which he remarks: "I first had the assistance in anatomy of Andreas Vesalius. . . . After him, Michael Villanovanus, a man very distinguished in learning of all sorts and scarcely second to anyone in Galenical learning, usually assisted me in dissections."[20] This statement is interesting for several reasons. It has frequently been interpreted as meaning that Vesalius and Servetus were fellow students in Paris. Actually, Guinther mentions them in chronological sequence since Vesalius had left Paris in 1536 before the arrival of Servetus who, moreover, did not enroll in the medical school until 1538 when Vesalius was already in Padua. Furthermore, Guinther goes on to describe Vesalius as a "youth" which, indeed, he was since he had come to Paris at the age of nineteen. On the other hand, Servetus is termed a man—he was twenty-seven—of considerable learning and particularly learned in Galen's writings.

One further member of the medical faculty with whom Servetus became acquainted was Jean Tagault, the dean. This, however, concerned an unpleasant episode to which it was presumably not politic to refer in Geneva. Suffice it to say that Servetus was lecturing on judicial astrology, that is, the forecasting of future human events from celestial phenomena. Ordered by Tagault, and eventually by the entire university, to cease, Servetus resorted to an earlier pattern and sought to publicize his position by printing

17 f.59a. *Razon universal de los jarabes . . . traducida al espanol por el Dr. J. Goyanes Capdevila . . .* (Madrid, 1935), p. 445.

18 March 24, 1537/38. Wilbur, *op. cit.,* p. 118.

19 According to the interrogation at Geneva, 1553: *respond quil a estudie soubz Iaques Silvyus, Guiterius, Andernacus, Fernel, et a encores les signatures deulx et que sez letres sont demorees a Vienne. Calvini opera,* VIII, 780.

20 *Anatomicarum institutionum ex Galeni sententia libri IIII* (Basel, 1539), Preface.

a brief tract justifying astrology on the authority of selected statements drawn from Galen, Hippocrates, Aristotle, and Plato.[21] And when by order of the Parlement of Paris the work was banned and Servetus ordered to respect the authority of the university, he chose rather to depart from Paris. This was somewhere toward the end of February 1539.

There is no evidence that Servetus had received a medical degree at Paris. Nevertheless, after some wanderings he established himself as a physician in the town of Charlieu[22] some forty miles from Lyons, and years later in Geneva he mentioned two incidents of this period. The first refers to a projected marriage which he finally abandoned because of the belief that he was impotent. The second casts some light on the medical ethics of the time and the dangers of a successful practitioner. The report of the Genevan interrogation presents this information as follows:

> When he was in the city of Charlieu, one night going to visit a patient, through the envy of another physician of the aforesaid city he was set upon by certain of the [physician's] relatives and friends. [Servetus] was wounded and also wounded one of the others as a result of which he was placed under arrest for two or three days.[23]

From Charlieu Servetus returned to Lyons and thereafter established a medical practice in Vienne. This was done as the result of an invitation from Pierre Palmier, Archbishop of Vienne, a former auditor of Servetus' lectures in Paris and now apparently his patron. At any rate, a second edition of Ptolemy's *Geography* published in 1541 contains a dedicatory preface to the archbishop and certain statements in the work are softened, presumably for the pleasure of this patron. Whereas in 1535 Servetus had denied any efficacy to the royal touch in cases of scrofula, now he remarks: "I have heard that from time to time many have been cured."[24]

Whether his medical practice was very lucrative or not, at least Servetus seems to have been able to live in comfort. He had, furthermore, the company of a small group of scholars gathered about the archbishop, and Lyons was only a few miles away, close enough that Servetus might continue to edit works for the press,

21 Henri Tollin, "Michael Servet's Pariser Process," *Dtsch. Arch. Gesch. Med.*, 1880, 3, 183-221.

22 This despite Servetus' statement *quil est docteur en medicine, maistre es ars de Parys*. The record of the interrogation continues: *Et quil a estudie ladicte medicine a parys, et quil a pratique deux ou trois ans a Charlieu, a 10 ou 12 lieux de Lyon, et de la a Vienne, la ou il a pratique 10 ou 12 ans ladicte medicine. Calvini opera*, VIII, 767. Also see, Tollin, "Michael Servet in Charlieu," *Dtsch. Arch. Gesch. Med.*, 1885, *8*, 76-96.

23 *Calvini opera*, VIII, 769.

24 (Lugduni, 1541), "Gallia."

and between 1546 and 1548, he saw three further editions of his *Syrups* published there. Furthermore, in his capacity of editor he now began to revert to the interest of his first career, that of theology. In 1542 a Latin Bible, frequently called the Pagnino Bible, was published under his editorial direction;[25] in 1545 yet another Bible;[26] and somewhere in this period a Spanish version of the *Summa* of St. Thomas Aquinas.[27]

The interest in theology had apparently always been smoldering not too far below the surface of Servetus' mind, and with his additional work on Bibles and religious commentaries it now blazed forth to become the major force in the last years of his life. Although he had previously failed to convince either Zwinglian or Lutheran authorities, nevertheless he seems to have believed that there was yet the possibility of winning over Calvin to his views on the reform of Christianity. Through the aid of a bookseller as intermediary, Servetus entered into correspondence with the Genevan reformer, requesting his explanation on various theological points and then characteristically proceeding to denounce such explanations as Calvin sent.[28] It was, of course, futile from the beginning. Servetus, dogmatic to the end, was interested not in learning but in teaching, and although Calvin broke off the correspondence, Servetus sought to continue it by sending him not only a long series of letters but such various works of Calvin as he could obtain, to which he added insulting marginalia.[29] It was foolhardy and useless except for the enmity that it aroused in Calvin.

As on previous occasions when he had been thwarted by authority, so now Servetus resorted to his usual procedure of seeking to broadcast his beliefs over the head of such authority. Thus he composed his *Christianismi restitutio* in its final form between 1548 and 1552 and had it secretly printed and bound, ready for distribution early in 1553.[30]

Fortunately, the exposure of Michael Villanovanus as the heretic Michael Servetus, indirectly the work of Calvin, did not occur until the completion of the book so that despite Servetus' imprisonment in Vienne and thereafter his escape and flight which

25 *Biblia Sacra ex Pagnini tralatione* (Lugduni, 1542).

26 *Biblia Sacra cum glossis* (Lugduni [- and Vienne], 1545).

27 No copies of this work are known today.

28 The intermediary was Jean Frellon, printer and publisher of Lyons. On the first correspondence, see *Calvini opera,* VIII, 482-500.

29 *Calvini opera,* VIII, 649-720.

30 Printed by the publisher Balthazar Arnoullet and his brother-in-law and director of the press, Guillaume Guéroult. While they were aware that the work was critical of Calvin, it is not certain that they were aware of the full nature of its heresies.

led him to Geneva and his tragic end, we have not been denied either the final statement of his religious beliefs or, as regards our present purpose, his amazing and tantalizing description of the pulmonary circulation.

It is not the present intention to consider in detail Servetus' description of the pulmonary circulation, nor the idle question of priority of discoverer, Servetus or Columbus, since the element of nationalism has made unanimous agreement impossible. Furthermore, the discovery was in the air and many persons had been preparing the way for it. Rather, the important question remaining is how did Servetus gain this glimmer of truth.

In the course of his description and after remarking that the right ventricle of the heart transmits its blood to the left ventricle, he adds, "not through the middle wall of the heart, as is commonly believed, but by a very ingenious arrangement . . . by a long course through the lungs." This, Servetus remarks, represents "a truth which was unknown to Galen," and he refers specifically to books VI and VII of *De usu partium*.[31] This statement is correct if by it we understand Servetus to refer merely to a difference in emphasis, since Galen had, in fact, presented the fundamental information necessary for the discovery and description. Here let us remember that Servetus has revealed himself as a confirmed and literal student of Galen.

The basic problem of both Galen and Servetus was how to move the blood from the right ventricle of the heart to the left. Galen had declared that the blood sweated through minute openings in the septum of the heart although there was some passage by anastomosis between the minute branchings of veins and arteries. Servetus announced that the transit occurred by a long course through the lungs although a very little blood, as he said, may pass through the septum of the heart. We may then say that there were two possible routes for the blood and that by the closing of the one, the other became essential, and already Vesalius in 1543 had cast some doubts on the passage through the septum of the heart although his complete denial of this route does not appear until 1555.[32] Nevertheless, the doubt is there from 1543, and either in relation directly to Vesalius or through the influence of his book there must have been discussion on this point among physicians although they were still too timid to express their anti-

[31] *Christianismi restitutio* (reprint of 1790), p. 171.

[32] *Fabrica* (1543), p. 588.

Galenical stand in the permanence of print. In essence, Servetus without doing violence to the anatomical facts of Galen, "the traditional authority," simply made what might be called a quantitative reversal in the functions of the parts involved by stating that the bulk of the blood passed through the lungs from the pulmonary artery into the pulmonary vein, of course by anastomosis between the veins and arteries described by Galen, while a very little, as Servetus said, might pass through the septum of the heart. It seems quite possible that Servetus did not actually believe in the permeability of the septum, but Galenical tradition caused him to refrain from a clear denial.

The problem is then resolved into a further question. Why did the literal-minded Servetus reverse Galen's arrangement? Here it seems likely that the requirements of theology were responsible. Despite Servetus' interest in medicine it must not be forgotten that to a considerable degree he was what might be termed a medical philologist and that his formal medical training in Paris was of brief duration. It is true that Servetus had been praised by Guenther of Andernach as his assistant in anatomy, but the kindly professor was himself more philologist than anatomist. Whereas in the *Apologia* against Fuchs in 1536 the theological interest was secondary to the medical, now the positions are reversed and medicine is merely an aid or adjunct to the major theological theme. What Servetus was now primarily concerned with was not the blood itself, but the divine spirit or essence of God for which the blood was merely the vehicle, because "It is not said that the divine spirit is principally in the walls of the heart, or in the body of the brain or of the liver, but in the blood, as is taught by God himself."[33] In short, the literal biblicist, aided by perhaps a slight but sufficient knowledge of anatomy, had influenced the literal Galenist to the degree of shifting not the facts of Galen but merely the emphasis that Galen had placed upon those facts. In the words of Servetus, ". . . not merely air, but air mixed with blood, is sent from the lungs to the heart through the pulmonary vein; therefore the mixture occurs in the lungs."[34] It was only in this way, by the inspiration of air and its mixture in the lungs with blood, that the divine spirit, or more correctly the vital spirit in which the spark of the divine spirit was contained, could be constantly renewed and reach to all parts of the body, or as he wrote, "the vital spirit

[33] *Christianismi restitutio,* p. 170.
[34] *Ibidem,* p. 171.

is then transfused from the left ventricle of the heart into the arteries of the whole body."[35]

If we consider that by the adoption of his "ingenious arrangement" Servetus has nullified the old Galenical idea of the ebb and flow of the blood, the implication of a complete circulation of the blood is obvious; indeed, not only physiology but theology especially required it. However, Servetus the theologian had made his point and had no reason to pursue the matter any further—presuming that he could have done so. In the final analysis Servetus' account must be considered not as anatomical or physiological, but rather a theological argument in support of a theological thesis.

[35] *Ibidem.*

New Light on Lady Mary Wortley Montagu's Contribution to Inoculation

ROBERT HALSBAND*

ALTHOUGH it is commonly known that Lady Mary Wortley Montagu was a pioneer advocate of smallpox inoculation (or variolation), the exact circumstances and extent of her activity has never been accurately or fully described by her biographers.[1] In a recent article which thoroughly discusses the introduction of inoculation in England, her activity is designated as one of three main causes, the other two being that inoculation was a popular practice spread by "a kind of social osmosis," and that the Royal Society publicized it through its proceedings and printed transactions.[2]

As a medical scientist Lady Mary was a sheer amateur. She was even, on occasion, a sarcastic critic of the profession;[3] and the fact that some physicians opposed inoculation aroused her further contempt. She was impelled to champion the innovation partly for personal reasons—to help her family and friends; but also because it aroused her intellectual curiosity and aggressiveness. Social problems like feminism and marriage excited her to cynicism or indignation, as her brilliant private letters and essays show. For a short time she also expressed her ideas publicly on these, along with other subjects, in the essays she wrote anonymously for *The Nonsense of Common-Sense*, a newspaper supporting Sir Robert Walpole's ministry.[4] Her advocacy of inoculation, then, is not an isolated, freakish interest; it is a significant addition to her stature as a social thinker.

Since she was an aristocratic lady she could not, by her code of conduct, engage in public controversy, or at least not under her

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1 The most ambitious and the most recent biographies are so inaccurate in this phase of her career as to be useless: Paston, George [Emily Morse Symonds]. *Lady Mary Wortley and her times.* 2d ed. London, Methuen, 1907, pp. 304-07. Gibbs, Lewis. *The admirable Lady Mary.* London, Dent, 1949, pp. 128-33.

2 Stearns, Raymond Phineas, with the assistance of George Pasti, Jr. "Remarks upon the introduction of inoculation for smallpox in England," *Bull. Hist. Med.*, 1950, *24*, 103-22.

3 *Letters and works.* Edited by Lord Wharncliffe, 3d ed. revised by W. Moy Thomas. London, Bohn, 1861. Vol. II, pp. 161, 178. In 1758 she asserted that Dr. Sydenham (1624-1689) was the only physician, living or dead, in whom she had faith (*ibid.*, 333).

4 *The nonsense of common-sense 1737-1738.* Edited with an introduction and notes by Robert Halsband. Evanston, Illinois, Northwestern University Studies, 1947.

own name. Her sponsorship of inoculation was no exception to this rule. Hence, until now we have found her ideas on it only in her Embassy Letters, which were probably composed in the early 1720's but not published until 1763, after her death. As I shall show, however, during the height of the controversy in 1722 she actually wrote an essay on inoculation, and had it published in a newspaper. It is unique, significant proof that in this revolutionary medical practice she was more than a private and passive advocate.

Her interest in a preventive for the smallpox was probably stimulated by the danger, and damage, she had suffered from the disease. As the young wife of Edward Wortley Montagu she had come to London at the beginning of 1715 to embark on a brilliantly promising career at the court of George I; at the end of December of the same year she was stricken with the disease. Her friend the Countess of Loudoun reported that the pocks [pustules] were very full, and then added: "if one his [*sic*] a pair of good Eyes to set up with the rest may be had, so that being mark'd is nothing."[5] To a beautiful woman the smallpox was a double danger, for if she won her life, she might lose her beauty. A contemporary description of the effects would horrify anyone, and particularly a woman ambitious for a career at court. Her skin might show deep pits, contractions, and ugly scars and seams; she might suffer disorders and malformations in the eyes, convulsive fits of several different kinds, tumors in various parts of the body, and very often general ill-health for the rest of her life.[6] With such an assortment of dangers, one wonders why a patient cared to survive!

"Poor Lady Mary Wortley has y^e^ small pox. . . ." gossiped James Brydges, another acquaintance; he thought that the loss of her beauty would disappoint her ambitious husband: "for y^e^ Ladies who know every minute of y^e^ day, what her distemper takes, say she hath them exceedingly full & will be very severely markt."[7] But a week later, as Lady Loudoun wrote, she was well out of danger.

What her own feelings were as she lay ill we know from her town eclogue entitled "Saturday: The Small-Pox," part of which

[5] 20 December 1715, 3 January 1715/6, Loudoun MSS. Huntington Library, San Marino, California.

[6] [Sarmento, J. à Castro.] *A dissertation on the method of inoculating the small-pox . . . .* By J. C. M. D. London, . Bickerton, 1721. p. 13.

[7] Sherburn, George. *The early career of Alexander Pope.* Oxford, Clarendon Press, 1934. p. 208, note.

contains her recollections set down within a few months of her recovery.[8]

> Ye, cruel Chymists, what with-held your aid!
> Could no pomatums save a trembling maid?
> How false and trifling is that art ye boast;
> No art can give me back my beauty lost.
> In tears, surrounded by my friends I lay,
> Mask'd o'er and trembled at the sight of day;
> MIRMILLO came my fortune to deplore,
> (A golden headed cane well carv'd he bore)
> Cordials, he cried, my spirits must restore:
> Beauty is fled, and spirit is no more!
> GALEN, the grave; officious SQUIRT, was there,
> With fruitless grief and unavailing care:
> MACHAON too, the great MACHAON, known
> By his red cloak and his superior frown;
> And why, he cry'd, this grief and this despair?
> You shall again be well, again be fair;
> Believe my oath; (with that an oath he swore)
> False was his oath; my beauty is no more![9]

As she herself stated, the verse is autobiographical.[10] She also identified two of her attending physicians: Mirmillo as Sir Hans Sloane (President of the Royal College of Physicians) and Machaon[11] as Sir Samuel Garth (physician to the late Queen Anne and a prominent Whig wit).[12] Her disbelief in Garth's optimism arose from his faulty diagnosis, in 1713, that her brother would recover from the smallpox.[13] In writing of the loss of her beauty she had some justification, for she suffered a pock-marked skin and the loss of her eyelashes.[14] Psychologically the disease entered the fabric of her imagination: in a French essay she wrote, an imitation of the sleeping beauty fairy tale, with its blessings and curses, when the infant princess is awarded a noble and touching beauty, the evil fairy decrees that she lose it by smallpox at the age when she begins to feel its advantages.[15] The terror of the smallpox, with its ravages, no doubt stimulated her interest in its prevention.

[8] Written before August 1716, when she left for Constantinople and put her town eclogues in Pope's keeping. See my article "Pope, Lady Mary, and the *Court Poems* (1716)," *Publications of the Modern Language Association of America*, 1953, *68*, 239-40.

[9] *Six town eclogues with some other poems.* London, M. Cooper, 1747, pp. 35-36.

[10] Stuart, Lady Louisa. "Introductory anecdotes," in Lady Mary's *Letters and works* (1861). vol. I, p. 88.

[11] Both the names Mirmillo and Machaon are used as pseudonyms for other physicians by Garth in his popular and controversial mock-epic *The dispensary* (1699).

[12] Identified by Horace Walpole, whose copy of the 1747 edition is now owned by Mr. W. S. Lewis of Farmington, Conn.

[13] Paston, *op. cit.*, p. 175.

[14] Stuart, *loc. cit.*

[15] See my article "An imitation of Perrault in England: Lady Mary Wortley Montagu's 'Carabosse'," *Comparative Literature*, 1951, *3*, 175-76.

In the spring following her illness (1716) her husband was appointed ambassador to Turkey, and when he left for the East that summer she accompanied him with their three-year-old son and a staff that included Charles Maitland, a surgeon. By the spring of 1717 they had reached Adrianople. Among the exotic customs she observed there, one which made a great impression she described in a letter to her friend Sarah Chiswell of Nottingham. "*A propos* of distempers, I am going to tell you a thing that I am sure will make you wish yourself here. The small-pox, so fatal, and so general amongst us, is here entirely harmless by the invention of *ingrafting*, which is the term they give it." Then she continued her description: a set of old women performed the operation by scratching open a vein in the patient and putting into it as much of the smallpox venom as could lie on the head of a needle. On the eighth day the patient ran a fever which kept him in bed two or three days, and afterwards seldom showed pockmarks. She was so much satisfied with the safety of the operation, she stated, that she intended to try it on her dear little son.

> I am patriot enough to take pains to bring this useful invention into fashion in England; and I should not fail to write to some of our doctors very particularly about it, if I knew any one of them that I thought had virtue enough to destroy such a considerable branch of their revenue for the good of mankind. But that distemper is too beneficial to them not to expose to all their resentment the hardy wight that should undertake to put an end to it. Perhaps, if I live to return, I may, however, have courage to war with them.[16]

Although her resolution sounds like rhetorical bravado, she meant it, for she carried it out at a propitious time in the following year, when she was settled in Constantinople.

The practice of inoculation in the East was then known, to some extent, by English scientists. An extensive description of it had been sent to the Royal Society in December 1713 by Emanuel Timoni, a physician educated at Padua and practising in Constantinople, and published in the Society's *Philosophical Transactions*.[17] Two years later the Royal Society printed another account by Jacob Pylarini, M.D., formerly Venetian Consul at

[16] *Letters and works*. vol. I, pp. 308-09. Lady Mary's letters from the Embassy are a compilation rather than her actual letters; but according to her memorandum of letters sent she did write to her father on the same day (1 April 1717) on the subject of smallpox (*ibid.*, p. 18).

[17] 1714, 29, pp. 72-82. Dr. Timoni (or Timone), of Italian birth, had visited England in 1703, when he was elected a Fellow of the Royal Society and received a degree from Oxford. Besides practising medicine in Constantinople, he took part in diplomatic affairs for the Sultan. The failure of one of his intrigues drove him to suicide in 1718. (Stearns and Pasti, *op. cit.*, pp. 109-110; British Museum, Add. MSS 22911, f. 196.)

Smyrna.[18] Whether or not Lady Mary knew of these printed accounts, she was certainly struck by the successful results of inoculation. To one of her pragmatic cast of mind the living proof, as she observed it in the East, was irrefutable.

At the end of 1717 she settled down in Constantinople to await the birth of her second child, while her husband traveled to the battle-ground of the Turks and Austrians in the north, attempting to negotiate a peace. At the beginning of the new year she gave birth to a daughter. Hitherto unknown is the significant fact that Wortley had engaged Dr. Timoni as physician to his family.[19] In the middle of March Lady Mary decided to have her son inoculated; and, although she does not mention Dr. Timoni, he may have had some connection with her decision.[20] On Sunday, 23 March 1717/18 she wrote to her husband: ". . . The boy was engrafted last Tuesday, and is at this time singing and playing, and very impatient for his supper. I pray God my next [letter] may give as good an account of him. . . . I cannot engraft the girl; her nurse has not had the small-pox."[21] A week later, on 1 April, she sent the good news: "y^{r} son is as well as can be expected, & I hope past all manner of danger."[22] Only these few laconic sentences by Lady Mary remain to tell us in her own words about the historic event.[23] But fortunately Maitland, who performed the operation, described it in full and with dramatic detail.

> About this Time [March 1717/18], the Ambassador's ingenious Lady, who had been at some Pains to satisfie her Curiosity in this Matter, and had made some useful Observations on the Practice, was so thoroughly convinced of the Safety of it, that *She* resolv'd to submit *her* only Son to it, a very hopeful Boy of about Six Years of Age: She first of all order'd me to find out a fit Subject to take the Matter from; and then sent for an old *Greek* Woman, who had practis'd this Way a great many Years: After a good deal of Trouble and Pains, I found a proper Subject, and then the good Woman went to work; but so awkwardly by the shaking of her Hand, and put the Child to so much Torture with her blunt and rusty Needle, that I pitied his Cries, who had ever been of such Spirit and Courage, that

[18] 1716, *29*, 393-99.

[19] Wortley to Joseph Addison, 26 August 1717, State Papers 97/24, Public Record Office (London).

[20] Voltaire later reported that the operation was opposed by the Embassy chaplain as being unsuitable for a Christian, but no documented proof of this survives. *Lettres philosophiques*. Edited by Gustave Lanson. Paris, Cornély, 1909. vol. I, p. 133.

[21] *Letters and works*. vol. I, pp. 352-53.

[22] Wortley MSS. vol. I, f. 309. This and other extracts from the MSS are printed here with the generous permission of their owner, the Earl of Harrowby.

[23] He was not the first English person to be inoculated. In February 1716 John Hefferman, secretary to the British ambassador in Constantinople, sent his two sons to London, both of them already "engrafted." (Letter from Dr. William Sherard, consul at Smyrna, quoted in Stearns and Pasti, *op. cit.*, p. 112.) But the Hefferman boys seem to be unmentioned in the inoculation controversy literature.

hardly any Thing of Pain could make him cry before; and therefore Inoculated the other Arm with my own Instrument, and with so little Pain to him, that he did not in the least complain of it.

The operation infected both arms, as the swellings showed. After the third day bright red spots appeared on the boy's face; between the seventh and eighth days he was feverish and thirsty for a few hours; and then about one hundred pocks appeared. They crusted and dropped off, without leaving any scars.[24] It was a complete success. In later advocating its use to others, Lady Mary could fairly claim that she had used her own child to experiment on.

In the spring of 1721, within three years of her return from the Levant, a severe smallpox epidemic broke out in England. Its toll among the upper class was high. When the Duchess of Argyll congratulated her sister-in-law on having two fine boys, she added that "he that has had the small pox may be reckoned as good as 2; so mortal as that distemper has been this year in town never was known."[25] The epidemic did not spare adults; in February (1721) its victims included James Craggs the younger, a politician and friend of Lady Mary's, and her young cousin Lady Hester Fielding.[26] It became so serious that, according to newspapers, many ladies declined to pay or receive visits.[27] At such a time any news of a method of preventing the disease would be welcome. In March appeared a pamphlet by a London physician describing the method of inoculating for the smallpox.[28] The following month the eminent Walter Harris, in an address before the Royal College of Physicians, made a passing reference to the practice of inoculation in Constantinople.[29] At the same time Lady Mary stepped forward, privately, and took action.

In April (1721) she sent for Maitland, who had retired to the country after his return from the Embassy, and told him that she was resolved to have her daughter inoculated. As Maitland recalled the episode, he postponed the operation for better weather, and also requested the presence of any two physicians—as safeguards and as eyewitnesses. At first Lady Mary refused, because

24 Maitland, Charles. *Account of inoculating the small pox.* 2d ed. London, Peele, 1723. pp. 7-8.

25 27 March [1721]. Historical Manuscripts Commission. *Fifth report.* London, 1876. p. 618.

26 *Weekly Journal or Saturday's Post,* 18, 25 February 1721.

27 *Applebee's Original Weekly Journal,* 4 March 1721.

28 [Sarmento, J. à Castro.] *Op. cit.*

29 Creighton, Charles. *A history of epidemics in Britain.* Cambridge, University Press, 1894. vol. II, p. 467.

(he surmised) she wanted it kept secret or perhaps feared it would be unsuccessful; but then she consented to his request. He ingrafted both arms of the patient: "the Child was neither blooded nor purg'd before, nor indeed was it necessary, considering the clean Habit of Body, and the very cool, regular Diet she had ever been kept to from her Infancy." All went well. Three "learned Physicians of the College were admitted, one after another, to visit the young Lady . . . and will on all Occasions declare, as they hitherto have done, that they saw *Miss Wortley* playing about the Room, chearful and well, with the Small Pox rais'd upon her. . . ." Other visitors—Lady Mary's friends, probably—came also to witness the miracle of medicine.[30]

According to a contemporary medical writer the operation was of signal importance, for the earlier commentaries by Timoni and Pylarini, printed by the Royal Society, "were regarded as *Virtuoso*-Amusements" until Lady Mary sponsored the operation by having it performed on her own daughter.[31] Her action so impressed Dr. Keith, one of the physicians who observed it, that he had his surviving son inoculated in May.[32] Popular interest was not slow in following. In June (1721) one of the weekly newspapers printed a description of inoculation, which could have been put together from Timoni or Castro.[33] Another paper reprinted it, but then a week later apologized for the account "inserted by way of amusement," calling it a "visionary experiment."[34] Lady Mary had taken the most effective step to make the experiment a practical one; but its main notoriety arose from the partisanship of her friend Caroline, Princess of Wales.

There is not, unfortunately, any direct testimony to prove that Lady Mary personally enrolled the Princess on the side of inoculation. Several circumstances make it likely that she did. The Princess, whose court she attended before and after her journey to Constantinople, had once been the victim of her clever wit in the satiric eclogue, "The Drawing-Room"; and even after reading the poem had forgiven her.[35] On her journey Lady Mary had sent her

30 Maitland, *loc. cit.*

31 Douglass, William. *A practical essay concerning the small pox.* London, Innys, 1730. p. 67. As a physician in Boston, Douglass's opinion is questionable; but it is confirmed in a London newspaper, as given in 34 below.

32 Maitland, *op. cit.*, p. 11; Creighton, *op. cit.*, p. 468.

33 *Weekly Journal or British Gazetteer,* 10 June 1721.

34 *Applebee's Original Weekly Journal,* 17, 24 June 1721.

35 See my article "Pope, Lady Mary, and the *Court Poems* (1716)," *op. cit.*, pp. 244, 247.

Royal friend at least one letter.[36] Sir Hans Sloane, whom the Princess later consulted about inoculation, stated elsewhere that Lady Mary and her husband had written "about this practice, and the advantages of it, to the court and their acquaintance here, and afterwards brought into England their inoculated son, in perfect health."[37] Another physician, whose testimony is only contemporary hearsay, remarked that the royal family had been encouraged by the inoculation of Lady Mary's daughter.[38] This belief is borne out by the chronological sequence of events.

In May, soon after Miss Wortley had recovered, one of Caroline's three little daughters fell ill—of the smallpox, it was thought, until her illness was diagnosed as scarlet fever.[39] A few months later all three princesses fell ill.[40] Caroline then determined to test the new safeguard in a reasonable, experimental way. At her request six criminals in Newgate condemned to death were allowed to volunteer for the operation, with freedom as their reward should they survive. Maitland at first refused but was later persuaded to act as surgeon.[41] Many witnesses watched the operation: physicians, surgeons, the apothecaries to the Prince and Princess, and members of the Royal Society. After the operation, Maitland —as a later antagonist complained—was perfectly confident of his success, and boasted of it openly in Child's Coffee House.[42] His optimism was justified, for the inoculation ran its expected course in five of the patients, and with no effect on the sixth, who had already had the disease. All of the criminals won their freedom.[43] The temper of the times was highly favorable; John Vanbrugh, the playwright and architect, was assured by several physicians that inoculation had proved itself.[44] But Caroline, still cautious,

36 *Letters and works.* vol. I, pp. 18, 281-83.

37 "An account of inoculation by Sir Hans Sloane, Bart. given to Mr. Ranby, to be published, Anno 1736. . . . Read Feb. 19, 1756," *Philos. Trans.*, 1756, *49*, 517.

38 Douglass, *loc. cit.* But the statement by W. H. Wilkins that "Lady Mary would certainly have failed had not Caroline stood by her side from first to last" is unsupported by any evidence (*Caroline the illustrious.* London, Longmans, Green, 1901. vol. II, pp. 154-55).

39 *Applebee's Original Weekly Journal*, 13 May 1721.

40 *Weekly Journal or British Gazetteer*, 22 July 1721.

41 "An account of inoculation by Sir Hans Sloane, Bart," *loc. cit.*

42 Massey, Isaac. *A short and plain account of inoculation. With some remarks on the main arguments made use of to recommend that practice, by Mr. Maitland and others.* London, Meadows, 1722. p. 3.

43 *Weekly Journal or Saturday's Post*, 12, 19 August, 9 September 1721.

44 Letter to Earl of Carlisle, 16 November 1721. *Works.* Edited by Geoffrey Webb. London, Nonesuch Press, 1928. vol. IV, p. 139.

wished to experiment further. In November the newspapers reported that she was having all the orphans in the Parish of St. James's inoculated at her expense.[45] But the operation was not performed, apparently, until the following spring, and only on eleven patients—six children, and then five hospital infants.[46] It was successful with all of them.

It was so much discussed and argued in the early spring (1722) that Maitland published his account with a dedication to the Prince and Princess of Wales.[47] In April Dr. Thomas Nettleton enrolled himself on the same side with a pamphlet in favor of it.[48] Rumors were current that Caroline intended to have her daughters undergo the operation.[49] She consulted Sir Hans Sloane, and although he told her that he favored it, he refused to persuade her to have it performed on patients of such importance. "The princess then asked me, if I would dissuade her from it:" he recalled, "to which I made answer, that I would not, in a matter so likely to be of such advantage. Her reply was, that she was then resolved it should be done . . ." and ordered him to speak to the King. The King, after very sensibly stating that in all operations there was danger of accidents, gave his permission.[50] On 17 April Claude Amyand, Caroline's surgeon, attended by Sloane, performed the operation on Princess Amelia and Princess Caroline, and with perfect success.[51]

Just as royalty set the fashion in other things, so they did in this. From her rural retreat at Twickenham Lady Mary wrote to her sister, "I suppose the . . . faithful historians give you regular accounts of the growth and spreading of the inoculation of the small-pox, which is become almost a general practice, attended with great success."[52] Lord Bathurst, who at this time was friendly

[45] *Applebee's Original Journal,* 18 November 1721; *Weekly Journal or British Gazetteer,* 18 November 1721.

[46] Creighton, *op. cit.,* p. 469. Stearns and Pasti (p. 114) state that ten children were inoculated.

[47] Advertisement dated 13 February 1722.

[48] *An account of the success of inoculating the small-pox; in a letter to Dr. William Whitaker.* London, 1722. Dated Halifax [Yorkshire], 3 April 1722.

[49] Baker, C. H. Collins and Muriel I. Baker. *The life and circumstances of James Brydges first Duke of Chandos.* Oxford, Clarendon Press, 1949. p. 238, note.

[50] "An account of inoculation by Sir Hans Sloane, Bart," *op. cit.,* pp. 518-19.

[51] Stearns and Pasti, *op. cit.,* p. 114. Douglass and Sloane give the date as 19 April; and Arnold C. Klebs adds that Amyand was attended by Teissier and Maitland as well as Sloane ("The historic evolution of variolation," *Johns Hopkins Hosp. Bull.,* 1913, *24,* p. 72).

[52] [April or May 1722]. *Letters and works.* vol. I, 461.

with her, had all of his six children successfully inoculated.[53] But then two patients died after the operation: a young servant in Lord Bathurst's household, and the two-and-half-year-old son of the Earl of Sunderland.[54] These cases of failure, as well as the royal sponsorship, led to the controversy's most violent phase in the summer of 1722.

It is usually asserted that Lady Mary introduced inoculation against a storm of universal protest, that all the physicians, clergy, and common people raised a clamor against it.[55] However, dramatic, this version is not true. Several of the clergy—certainly not all—attacked the practice of inoculation from their pulpits. One sermon, which in print spearheaded the theological opposition, was preached by the Reverend Edmund Massey on 8 July 1722 at St. Andrew's in Holborn.[56] It argued against the "dangerous practice" because inoculation opposes the will of God, who sends disease (including the smallpox) either to try our faith or to punish us for our sins. The sermon was answered by an anonymous, witty pamphlet which refuted the theological arguments, and chided the clergyman for his unchristian acerbity toward his opponents.[57] Maitland, who had published his account early that year, now issued a second edition to defend himself from Massey's vituperation; and the clergyman in turn issued a vindication of his sermon.[58] Some theological opposition continued, but in the opinion of Vanbrugh it was confined to clergy of the high church.[59] And in Boston, Massachusetts, where the smallpox epidemic and inoculation controversy also raged, six clergymen supported the practice.[60]

The opposition from the medical profession was more substantial, but, again, far from universal. Among those who supported it were John Arbuthnot, James Jurin, Richard Mead, and Hans Sloane—all of them highly eminent figures. The objections

53 *St. James's Journal*, 3 May 1722.

54 Douglass, *op. cit.*, p. 68.

55 *Letters and works*. vol. I, pp. 88-89. Paston, *op. cit.*, p. 304. Arkell, R. L. *Caroline of Anspach, George the Second's queen*. Oxford, Oxford University Press, 1939. p. 134.

56 *A sermon against the dangerous and sinfull practice of inoculation. . . .* London, Meadows, 1722.

57 *A letter to the Reverend Mr. Massey, occasion'd by his late wonderful sermon against inoculation*. London, Roberts, 1722.

58 *A letter to Mr. Maitland, in vindication of the sermon against inoculation*. London, Meadows, 1722.

59 Historical Manuscripts Commission. *Carlisle manuscripts*. London, 1897. p. 48.

60 Blake, John B. "The inoculation controversy in Boston: 1721-1722," *The New England Quarterly*, 1952, 25, p. 494.

which medical men (including apothecaries) raised were generally based on its risks to patients, the uncertainty of its protective power, and the danger of its spreading the disease.[61] An early and typical expression of these objections was set forth in a pamphlet by William Wagstaffe as a letter to another physician.

> Tho' the *Fashion* of Inoculating the Small Pox has so far prevail'd, as to be admitted into the greatest Families, yet I entirely concur with You in Opinion, that, till we have fuller Evidence of the Success of it, both with regard to the Security of the Operation, and the Certainty of preventing the like Distemper from any other Cause, Physicians at least, who of all Men ought to be guided in their Judgments chiefly by Experience, shou'd not be over hasty in encouraging a Practice, which does not seem as yet sufficiently supported either by Reason, or by Fact. . . . Physicians, I shou'd think, cannot with Prudence give into any thing which is the *peculiar Subject* of their Profession, merely because it has been cry'd up by those who are no Physicians, and have not the least knowledge of Distempers. . . . Posterity perhaps will scarcely be brought to believe, that an Experiment practiced only by a few *Ignorant Women,* amongst an illiterate and unthinking People, shou'd on a sudden, and upon a slender Experience, so far obtain in one of the Politest Nations in the World, as to be receiv'd into the *Royal Palace.*[62]

A physician in Portsmouth quickly stepped forward to refute Wagstaffe on medical grounds and Massey on religious ones.[63] The controversialists came from all sides.

It may have been Wagstaffe's attack on the practice of "ignorant women" that angered Lady Mary into taking up her pen to defend inoculation publicly. Her carefully composed essay, which survives in manuscript among her family papers, she entitled "A Plain Account of ye Inoculating of ye Small Pox by a Turkey Merchant."[64] She submitted it in some way to *The Flying-Post: or, Post-Master,* a popular London newspaper, where it was published in the issue of 11-13 September 1722—with no author designated except the anonymous Turkey Merchant. The editor of the newspaper, in preparing the essay for printing, did not confine himself merely to stylistic changes; he also eliminated all her criticism and sarcasm against physicians and their College, and in general softened her indignant, passionate tone. Now, for the first time, the essay can be printed in its original form.

61 Klebs, *loc. cit.*

62 *A letter to Dr. Freind; shewing the danger and uncertainty of inoculating the small pox.* 2d ed. London, Butler, 1722. pp. 3-6.

63 Brady, Samuel. *Some remarks upon Dr. Wagstaffe's letter, and Mr. Massey's sermon against inoculating the small-pox. . . .* London, Clark, 1722.

64 Wortley MSS. vol. VII, ff. 201-03.

A Plain Account of the Inoculating of the Small Pox by a Turkey Merchant[65]

Out of compassion to the numbers abused and deluded by the knavery and ignorance of[a] physicians,[a] I am determined to give a true account of the manner of inoculating the small pox as it is practised at Constantinople[b] with constant success, and without any ill consequence whatever. I shall sell no drugs, nor take no fees, [c]could I[c] persuade people of the safety and reasonableness of this [d]easy[d] operation. 'Tis no way my interest (according to the common acceptation of that word)[e] to convince the world of their errors;[e] that is, I shall get nothing by it but the private satisfaction of having done good to mankind,[f] and I know no body that reckons that satisfaction any part of their interest.[f]

The matter ought to be taken from a young person, of a sound constitution and the best sort of the small pox, when 'tis turned of the height. The old nurse, who is the general surgeon upon this occasion at Constantinople, takes it in a nut shell, which holds enough to infect fifty people, contrary to the infamous practise[g] here,[g] which is to fill the blood with such a quantity of that matter, as often endangers the life and never fails of making the distemper more[h] violent than it need to be. She opens the arms, and sometimes legs, with a small rip of a needle, and with the point of the same needle takes as much of the matter as will lie upon it, and mixes it with that drop of blood that follows the little incision. The wounds are bound up, with a small nut[i] still over them, which is thrown off in twelve or sixteen hours, and the inflamation appears, more or less, as the blood is more or less disposed to receive the infection. From that time the patient is confined to a warm chamber and a low diet, being utterly forbid wine or flesh meat. The eruption generally appears the seventh or eighth day afterwards. They give no cordials to heighten the fever, and leaving nature to herself, never fail of the good success[j] which generally follows a rational way of acting upon all occasions.[j]

The[k] murders that have been committed on[k] two [l]unfortunate[l] persons that have died under this operation has been wholly occasioned by the preparatives given [m]by our learned physicians, of whom I have too good an opinion not to suppose they knew what they did, by weakening bodies that were to go through a distemper. I am confirmed in this opinion by the unfair accounts that were given in the public papers of their deaths.[m] I believe 'tis much to be doubted if purges or any violent method ever brings the body into a moderate temper, which may always be done by a cool diet and

[65] The title was printed by the newspaper as "*An account of the inoculating the small pox at Constantinople, by a Turky-Merchant.*" In transcribing Lady Mary's manuscript I have written out the verbal contractions, and normalized the spelling, capitalization, and punctuation. The significant changes in the printed version are given immediately below, notes (a) to (q).

(a) Printed in the *Flying-Post* as: "some Persons"
(b) Added: "and other places in Turky"
(c) Changed to: "my Design is only to"
(d) Omitted
(e) Omitted
(f) Omitted
(g) Changed to: "in some Places"
(h) Added: "dangerous and"
(i) "Nut-Shell"
(j) Omitted
(k) Changed to: "Misfortunes that have happen'd to"
(l) Omitted
(m) Instead of this passage: "them; which is never done in Turkey."

regular hours; but as I am not[n] of the College,[n] I will not pretend to dispute with those gentlemen concerning their general practise in other distempers, but they must give me leave to tell them from my own knowledge, witnessed by every one of our company that has ever resided at Constantinople, and several thousands of those there that have happily undergone this operation, that their long preparations only serve to destroy the strength of body necessary to throw off the infection. The miserable gashes that they give people in the arms may endanger the loss of them, and the vast quantity they throw in of that infectious matter may possibly give them the worst kind of small pox, and the cordials that they pour down their throats may increase the fever to such a degree as may put an end to their lives. [o]After some few more sacrifices of this kind it may be hoped this terrible design against the revenue of the College may be entirely defeated, and those worthy members receive two guineas a day as before, of the wretches that send for them in that distemper.[o]

Since I writ this I have read some queries published in the *St. James' Evening Post* stated in a very unfair manner, most of the facts there mentioned being utterly false. However, I never will deny but 'tis in the power of [p]a surgeon[p] to make an ulcer with the help of lancet and plaster, and [q]of a doctor to kill by prescriptions.[q]

With her Turkey Merchant's letter[66] Lady Mary made her only public appearance as a propagandist for inoculation. Too much the aristocrat to enter the controversy openly, she was at the same time too aggressive a thinker to sit by passively when she believed in it so firmly. In her public rôle she used a prose style of blunt, strident vigor; it is a contrast to the glittering wit of her letters and verse couplets, for she was performing in a different arena of literary expression. This new essay is proof of her complex mind and versatile skill.

Less than two weeks after her essay appeared in print, a new antagonist sprang up. Isaac Massey, apothecary at Christ's Hospital, the boys' school, attacked the growing popularity of inoculation, and insisted that sufficient time must pass before the cure be accepted as safe and certain.[67] One of the advocates whom he refuted was the writer of "a Sham Turkey Merchant's letter" in the *Flying-Post*. He had thus penetrated the literary hoax, but ap-

(n) Changed to: "a Physician"

(o) This raw sarcasm is changed to: "After some few Experiments made with the Cautions I have honestly given my Countrymen (with respect to this Innocent and Easy Operation) I doubt not but they will be convinced that the Discovery is one of the Greatest Blessings that God Almighty hath bestowed upon Mankind."

(p) Changed to: "any unskilful Pretender"

(q) Changed to: "to kill by Errors in Prescription."

66 In the *Flying-Post* the last paragraph is headed P. S.; and to it was added the initials E. T.—which suggests Emanuel Timoni. But the manuscript is entirely in Lady Mary's hand, with her own minor alterations. By this time Dr. Timoni was dead; the initials may simply be the newspaper editor's attempt to throw a false scent on the trail of the true author, or to implicate E. Terry, a genuine Turkey-merchant.

67 Cited in Note 42 above.

parently not so far as to discover the actual writer. She remained effectively hidden for over two hundred years.

The opposition to inoculation reached its most extreme in an anonymous pamphlet, issued about the same time, which appealed to Parliament in its approaching session to regulate "that Dangerous Experiment."[68] As the year (1722) ended, however, the war of pamphlets abated, though they continued to appear sporadically. But the number of patients increased. By the end of the year there had been 182 operations, 61 performed by Nettleton, 57 by Maitland, and 17 by Amyand.[69] In the early spring of 1723 the practice was boosted by the public partisanship of Dr. Jurin, a Fellow of the College of Physicians, lecturer in anatomy, and secretary of the Royal Society; his statistics were irrefutable.[70]

The growing popularity affected Lady Mary even in her social life. As she wrote to her sister: "Lady Byng has inoculated both her children, and is big with child herself; the operation is not yet over, but I believe they will do very well. Since that experiment has not yet had any ill effect, the whole town are doing the same thing, and I am so much pulled about, and solicited to visit people, that I am forced to run into the country [Twickenham] to hide myself."[71] When she did agree to advise her friends, she would take her daughter with her as proof of the operation's success.[72] What her advice sounded like we can gather from her observation to her sister Lady Mar: "I know nobody that has hitherto repented the operation: though it has been very troublesome to some fools, who had rather be sick by the doctor's prescriptions, than in health in rebellion to the college."[73] Yet it is odd that her own relations were reluctant to trust themselves to her advice. At her daughter's inoculation she had invited her sister Lady Gower to send her small son, only to be refused. Two years later the boy died of the smallpox.[74] And not until 1725 did her father the Duke of Kingston allow his young daughter and grandson to be inoculated.[75]

68 *The new practice of inoculating the small-pox consider'd, and an humble appliation [sic] to the approaching Parliament for the regulation of that dangerous experiment.* London, Crouch and Dod, 1722.

69 Jurin, James. *A letter to the learned Caleb Cotesworth, M.D. . . . containing, a comparison between the mortality of the natural small pox, and that given by inoculation.* London, Innys, 1723. p. 5.

70 *Ibid.* He was answered by Francis Howgrave (Apothecary) in *Reasons against inoculation of the small-pox. . . . being a full answer to every thing which Mr. Maitland and others have advanced upon that subject. . . .* 1724. 2d ed. London, Clark, 1725.

71 *Letters and works.* vol. I. p. 468.

72 *Ibid.*, p. 90.

73 *Ibid.*, p. 471.

74 *Ibid.*

75 *Ibid.*, p. 482.

But the greatest irony is that her friend Sarah Chiswell, to whom she had addressed her Embassy Letter about inoculation, died in 1726—of the smallpox.[76]

Within seven years of the initial operation, statistics proved its overwhelming effectiveness. Between 1721 and 1728, 897 persons were inoculated, of whom only 17 (.002%) died, presumably of the operation. In the same period, of a total of 218,000 deaths in England, over 18,000 (almost 9%) died of the smallpox.[77] As in Turkey the best argument in favor of inoculation came from its practical success. More specifically, the well-authenticated reports of successful inoculation in New England had great influence in establishing the practice in England.[78]

As it became commonly accepted in England Lady Mary was celebrated as its introducer and popularizer. Aaron Hill paid effusive tribute to her in his verse published in *The Plain Dealer* of 3 July 1724, bestowing on her the double empire of "Protecting Beauty and inspiring Wit." Less poetic but equally rhapsodic praise appeared the next year in an inoculation pamphlet: "Now to the Prudence and Courage of this most Honourable Lady, what Praises are there not due for introducing so great a Blessing into our Native Country?"[79]

The blessing extended beyond her native country. Voltaire praised her for her effort, calling her *"une des femmes d'Angleterre qui a le plus d'esprit & le plus de force dans l'esprit. . . ."* He recommended that inoculation be adopted by the French for the sake of staying alive and keeping their women beautiful.[80] Vigorous opposition, some of it religious, delayed its adoption in France until after 1750. It became in the meantime a general rallying point for the *philosophes* of the enlightenment: "the history of inoculation is *in parvo* the history of the struggle of progress against conservative tradition." It served them as a weapon in the war against intolerance and superstition.[81] Lady Mary's own emancipation and enlightenment had led her to fight in the same kind of war.

[76] *Ibid.*, p. 499.

[77] Frewen, Thomas. *The practice and theory of inoculation. With an account of its success.* London, Austin, 1749. p. 46.

[78] Stearns and Pasti, *op. cit.*, p. 116.

[79] [Slare, F.] Williams, Perrott. *Some remarks upon Dr. Wagstaffe's letter against the small-pox. . . . With an appendix, in favour of inoculation, by F. Slare, M.D.* London, Gosling, 1725. p. 33.

[80] *Op. cit.*, pp. 133-34.

[81] Rowbotham, Arnold H. "The 'Philosophes' and the propaganda for inoculation of smallpox in eighteenth century France." *University of California Publications in Modern Philology*, 1935, vol. 18, no. 4, pp. 270, 284.

Even in her lonely old age, when she lived in retirement in Italy, she was remembered in England for her heroism in "conferring health and life to thousands, by bringing into her own country a practice, of which ages to come will enjoy the benefit."[82] But the most fulsome praise came after her death; and—with wheel making a full turn—it was printed as the preface to a sermon in defense of inoculation. "Ever indebted will these kingdoms be to the late honourable lady Mary Wortley Montague . . . for the great and noble blessing, Inoculation. Thousands of subjects, the tender husband, the affectionate wife, fond parents and pious children engrave her name in deep characters on their hearts and will record it forever with gratitude and praise."[83]

Her pioneer work was praised from the pulpit to the stage; for a few years later, Oliver Goldsmith's comic Mrs. Hardcastle insisted: "I vow, since inoculation began, there is no such thing to be seen as a plain woman."[84] Lady Mary would have liked that tribute.

[82] Burges, James. *An account of the preparation and management necessary to inoculation.* London, Vaillant, 1754. pp. 3-4.

[83] Houlton, Robert. *The practice of inoculation justified, a sermon preached at Ingatestone, Essex, October 12, 1766, in defence of inoculation.* Second Edition. Essex, Hassall, n. d. pp. v-vi.

[84] *She stoops to conquer,* 1773. Act II.

Economic and Social Policy in the Development of Public Health

An Essay in Interpretation*

GEORGE ROSEN**

I

PUBLIC health as an area of human interest and activity owes its existence to the biological and social nature of man. As a biological organism, man is subject to fundamental needs, such as alimentation and excretion, and to vital processes whose varying manifestations are summed up in the concepts of health and disease. Throughout history, men have lived in larger or smaller social units and have had to reckon with the consequences of these biological facts for the welfare of the group. The ways in which this has been accomplished have been determined chiefly by the social and economic organization of the group and by the scientific and technical means available to it.

For this reason the history of public health must deal with two components. In one aspect it reflects the development of medical science and technology. Understanding of the nature and cause of disease provides a basis for preventive action and control. But the effective application of such knowledge depends on a variety of non-medical elements, basically on economic and social factors. This is the other major strand in the fabric of public health, and it is with this component that we are presently concerned.

The various elements of society are related to each other as parts of a total structural configuration. At any given time and place the dynamic or functional aspect of society is revealed in the circumstance that the social structure as a whole, and its constituent elements in varying degree, are directed toward definite goals in terms of implied or explicitly accepted values. The implementation and realization of these values require the formulation, statement, and application of demands and expectations concerning the future. The term *policy* is generally employed for such a projected program of goals and practices. Therefore, as used here, economic and social policy refers to the principles of

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societal action or inaction, most often exercised through the agency of government—the *agenda* or *non agenda* of the state as Bentham called them—in regard to economic and social problems.

The foregoing considerations lead directly to the thesis of this study, namely, that economic and social policy has been a fundamental factor in the development of public health. The historical significance of this factor has been profound and broad. In innumerable ways of which we are often unaware, earlier policy continues to affect us. Directly or indirectly, many far-reaching legislative and administrative developments in public health have emerged on the basis of economic and social policy. Indeed, it is no exaggeration to say that it is impossible to understand fully the evolution and meaning of public health, especially in the modern period, without recognition and comprehension of the rôle of economic and social policy. Here it will not be possible to explore this thesis in all its historical ramifications. Instead, we shall endeavor to see how it applies in one case, namely, in some developments of public health in Great Britain from the seventeenth century to the present. Where it appears relevant, attention will also be directed to appropriate points in the evolution of public health in other countries.

II

Mercantilist ideas and practices were as characteristic of England in the seventeenth and earlier eighteenth centuries as of the contemporary continental states.[1] For policy makers in all these countries the important question was: What policy must the government pursue in order to increase the national wealth and the national power? In each country, however, the answer given to the question was an answer in terms of its historical experience, its political structure, and its economic and social circumstances.

That industry was one of the chief means by which a country could attain productivity and wealth appeared clear to public officials, men of affairs, and writers on economics and politics. With the growth of industry in seventeenth century England, production came to be regarded as a matter of central importance in economic activity, and labor, one of the most important factors of production, as an essential element in the generation of national

[1] E. Lipson, England in the age of mercantilism. *Journal of Business History* 1932, 4, 691-707. Leo Gershoy, *From despotism to revolution 1763-1789*. New York and London, Harper and Bros., 1944, pp. 39-43; Maurice Dobb, *Studies in the development of capitalism*. London, George Routledge and Sons, 1946, p. 209.

wealth. Obviously, any loss of labor productivity due to illness and death was a significant economic problem.

It was in the interest of the state to have the largest possible number of healthy productive subjects. Moreover, since population was a factor of production it was essential to know the number and the "value of people,"[2] especially of those occupational groups esteemed most productive. It was the recognition of this need in England in the seventeenth century that led to the first significant attempts to apply statistical methods to the public health.

Another aspect of the larger question of population and productivity concerned the poor. To increase population was eminently desirable, but, unless employed, people were only potential sources of wealth. The problem of poverty was thus inextricably linked with that of employment, so that the poor occupied a strategic position in the logic of English social and economic policy. Numerous schemes for dealing with this question were proposed, and in this connection various individuals began to explore the problem of social action in matters of health, inclusive of medical care.

No one perhaps is more significantly representative of these trends than William Petty, physician, wealthy landowner, scientist, and above all, social projector. He personifies that combination of utilitarianism, commercial drive, and experimental philosophy which characterized the approach to social, economic, and health problems in the period following the Commonwealth.[3] Petty's proposals for the advancement of knowledge and educational reform stem in a straight line from Bacon's *New Atlantis* by way of Hartlib's *Macaria* and point to the enthusiastic promulgation of elaborate projects for commercial undertaking, technological innovation, and social reform during the later seventeenth and early eighteenth centuries. Petty is representative, however, not only as a projector, but equally as a pioneer in the quantitative study of social phenomena. The application of the numerical method to the analysis of social problems was an event of first-rate importance and was destined to prove extraordinarily fruitful for the study and development of public health. Petty was convinced that such problems could be dealt with most effectively in terms of func-

2 The phrase "value of people" is used repeatedly by William Petty. See *The economic writings of Sir William Petty. . . .* edited by C. H. Hull. Cambridge, at the University Press, 1899, 2 vols., pp. 108, 152, 267, 454.

3 W. E. Houghton, Jr., The history of trades: its relations to seventeenth century thought. *J. Hist. Ideas,* 1941, 2, 33-60.

tional analysis and measurement, what he called *political arithmetic*. "The method I take," he wrote, "is . . . to express myself in terms of number, weight, or measure; to use only arguments of sense, and to consider only such causes, as have visible foundations in nature. . . ."[4]

While Petty coined the term political arithmetic and outlined the significance of a quantitative study of social fact, the first important demonstration of the usefulness of the statistical approach was undertaken by his friend John Graunt. His classic contribution appeared in 1662 under the title *Natural and Political Observations . . . upon the Bills of Mortality*. While Graunt's work was not without antecedents, he blazed a new trail and brought to light a number of important facts.[5] In the first place, he demonstrated the regularity of certain social and vital phenomena. Thus he noted "that among the several casualties some bear a constant proportion unto the whole number of burials; such are chronical diseases, and the diseases whereunto the city is most subject; as for example, consumptions, dropsies, jaundice, gout, stone, palsie, scurvy, rising of the lights or mother, rickets, aged, agues, fevers, bloody flux, and scowring; nay, some accidents, as grief, drowning, men's making away themselves, and being kill'd by several accidents, & c. do the like; whereas epidemical and malignant diseases, as the plague, purples, spotted fever, smallpox and measles do not keep that equality: so as in some years, or months there died ten times as many as in others."[6] Secondly, Graunt was the first to note the excess of male over female births as well as the eventual approximate numerical equality of the sexes. Thirdly, he called attention to the excess of the urban over the rural death rate.

Although Graunt seems to have been aware of the social significance of his studies, he did not pursue further this aspect of the matter. It was precisely in this area, however, that Petty made his most pregnant contribution. In line with mercantilist thought and practice, he approached problems of health and disease in terms of

4 Petty, *Economic writings*, vol. 1, p. 129.

5 Jakob Burckhardt, *The civilization of the Renaissance in Italy*. London and New York, Phaidon Press, 1944, pp. 45-47, 50-52; Alfred von Martin, *Soziologie der Renaissance*. Stuttgart, Ferdinand Enke Verlag, 1932, pp. 26-31; G. N. Clark, *Science and social welfare in the age of Newton*. Oxford, Clarendon Press, 1937, pp. 121-132.

6 Petty, *Economic writings*, p. 352. A good deal has been written about the possible authorship of the Graunt treatise by Petty. Those interested may consult the following: Petty, *Economic writings*, pp. XXXIX-LIV; *The Petty Papers*, 1927, vol. II, pp. 273-284; Major Greenwood, *Medical statistics from Graunt to Farr*. Cambridge, At the University Press, 1948, pp. 36-39.

their significance for the political and economic strength of the state. This characteristic orientation is clearly revealed whenever he deals with matters of health, in his discussion of population, and in his various statistical proposals. Throughout his numerous published and unpublished writings occur schemes to increase the power and prestige of England.[7] As an essential element of these schemes, Petty urged repeatedly the collection of statistical data on population, trade, manufacture, education, diseases, revenue, and many other topics. The breadth of his approach is strikingly illuminated by his "Method of enquiring into the state of any country." This memorandum outlined a complete scheme for a political, economic, social, and health survey. Among the topics listed are not only a census of the population and the nature of the public revenue, but even such questions as "What are the bookes that do sell most. . . ."[8]

Within this broad frame of reference Petty was able to grasp clearly the relations and implications of a number of public health problems. Thus, he saw that it was not enough simply to recognize natural fertility and population as major conditions of national prosperity. The acceptance of this premise went hand in hand with the responsibility for removing impediments to the full development of these resources. A major aspect of this responsibility was the creation of conditions and facilities which would promote health, prevent disease, and render medical care easily accessible to those who should have it. The achievement of these aims required that medical knowledge be advanced to the greatest degree possible, and Petty pointed out that it is the duty of the state to foster medical progress.[9] In 1648, Petty had published in London a small book entitled *The Advice of W. P. to Mr. S. Hartlib for the Advancement of Some Particular Parts of Learning.* In it he had recognized the crucial importance of the hospital in the training of physicians and in the furtherance of medical research, and to this point he returned again and again. In various connections Petty urged the establishment of hospitals, not only as a general recommendation, but also in specific proposals. Thus, in 1687, in "An Essay for the Emprovement of London," Petty proposed "That there bee a Councill of Health viz. for the Plague, acute

[7] *The Petty Papers. Some unpublished writings of Sir William Petty,* edited from the Bowood Papers by the Marquis of Lansdowne. London, Constable & Co., 1927, 2 vols., vol. I, pp. 255-258, 263-276.

[8] *Ibid.,* vol. I, p. 176.

[9] *Ibid.,* vol. II, p. 176.

and epidemicall diseases, aged foundlings, as also for persons and houses of correction, and all sorts of hospitalls and women in childbed."[10] Another memorandum composed in the same year suggests a hospital of a thousand beds for London. For Petty, the basic political and economic importance of population was axiomatic. Consequently, any measures to prevent impairment of population by disease and death were matters of great concern. Control of communicable disease, especially plague, and the saving of infant life would, Petty felt, contribute most toward this end. This conviction is reflected in his various suggestions for combating plague and establishing maternity hospitals. He recommended the establishment of isolation hospitals to which plague patients would be removed and where they would receive medical care. To buttress this recommendation, and in general the usefulness of any measures intended to combat the ravages of the plague, he undertook to calculate the economic loss due to the disease.[11] Similarly, he advocated the creation of maternity hospitals, having in mind particularly unmarried women. Petty contemplated that in return for such provision by government, the children would become wards of the state and serve it for twenty-five years, thus adding to the labor resources of the country. He also believed that certain occupational groups in the population were of direct concern to the state. In keeping with this point of view, are his suggestions that studies be made of occupational morbidity and mortality.[12]

Finally, Petty realized that to achieve these aims an adequate supply of medical personnel would be required. Consequently, he proposed that an analysis be made of health needs, using the methods that Graunt had employed and then on this basis to calculate the numbers of physicians, surgeons, and others necessary to meet these needs. In short, Petty proposed that the number of medical personnel be planned and adjusted to meet the actual need for medical care.[13]

Petty was not alone in dealing with health problems, or in attempting to study them quantitatively. Among his contemporaries and successors, these interests were expressed in varying degree, and some were keenly alive to the importance of a healthy population as a factor in national opulence. One might mention

[10] *Ibid.*, vol. I, p. 35.

[11] For Petty's recommendations concerning the plague, and his various estimates of the economic loss due to the disease, see his *Economic writings*, pp. 109-110, 151, 303, 463, 536; also *The Petty Papers*, I, pp. 33, 36-40, 256-257.

[12] *Petty Papers*, I, pp. 195, 267; II, 55, 170; Petty, *Economic writings*, p. 259.

[13] Petty, *Economic writings*, p. 27.

Samuel Hartlib, Gerrard Winstanley, or Peter Cornelius Plockhoy, but perhaps closest to Petty was his younger contemporary Nehemiah Grew, also a physician, who is best known today for his work in plant anatomy. Sometime in 1707 apparently, Grew prepared for Queen Anne a memorandum entitled, *The Meanes of a Most Ample Encrease of the Wealth and Strength of England in a Few Years Humbly represented to her Majestie In the Fifth Year of Her Reign.*[14] As the title indicates, this document outlined an economic program to enhance the prosperity and power of England. Grew's focus of interest was the same as Petty's, and his handling of health problems occurs within a similar context. He knew Petty, to whom he refers as "my late Honoured Friend," and frequently mentions Petty's calculations, though he does not always accept them. In his opinion the four basic elements in the economic anatomy of England are land, manufactures, foreign trade, and population. Ultimately, however, Grew's program depended on the size and quality of the population, and to this subject he devoted the fourth section of his memorandum. Grew assumed as axiomatic the need for increasing population to provide the necessary labor power. Among his recommendations toward this end he urged that the state do all in its power to maintain health and prevent disease. Grew emphasized the economic burden of disease, commenting that in economic terms the sick are worse than dead because they become either public or private charges. To make medical care available to all, Grew proposed that the government regulate physicians' fees according to their experience. He felt that if this were done the cost of medical care could be reduced and thus made accessible to those who needed it.

Despite their bold and penetrating character, the ideas of Petty and Grew had no immediately tangible results. Their proposals did not lead to concrete action because they ran contrary to two major interrelated trends, one political and administrative, the other economic and social. Effective implementation would have required the existence of a well-developed local administrative mechanism operating under centralized control, in a manner comparable to the organizations of Prussia or France. But it was precisely this network of administration which had disappeared after the Revolution. Cunningham, the economic historian, employed the term "parliamentary Colbertism" to describe this period and its con-

[14] E. A. Johnson, *Predecessors of Adam Smith. The growth of British economic thought.* New York, Prentice-Hall, 1937, pp. 117-138.

tinuation in the eighteenth century.[15] Although this designation is only partly correct, it calls attention to contemporary French developments, and by inviting comparison makes it possible to focus more sharply the characteristic features of English evolution. Colbert created a whole system of administrative regulation under central control, and built up a bureaucracy to keep the machinery in operation. In England, on the other hand, the state took on a form during the seventeenth century in which local government was carried on largely by local officials, among whom the justices of the peace were most important. The local officials were in theory representatives of the central government, and a centralized administrative apparatus had been developed under the first Stuarts; but the Civil War broke the bond between the local authorities and the Crown, and neither the Commonwealth nor the restored monarchy was able to re-establish the old system. Furthermore, for reasons to be presented shortly, the focus of governmental interest following the Restoration and particularly after the revolution in 1688 shifted more and more to commercial and colonial policy, and to governmental action in these areas.

As the control of the Crown relaxed, local government in the course of the eighteenth century became increasingly a matter of local initiative. Local government was carried on by the counties, and by the parishes into which the counties were divided. As a result, the county officials, especially the justices of the peace, gained in power and prestige. It was to the justices that the parish authorities were accountable.[16] There was little explicit theorizing about this trend of development, but it was clearly reflected in the treatment of social problems, and provided the frame of reference within which thought and action in matters of health must be viewed. Indeed, the outstanding feature of internal English administration during the period from the Act of Settlement and Removal, passed in 1662, to the Poor Law Amendment Act of 1834 is its intensely parochial character. This had important results on the development of public health, since there was no machinery to subordinate the interests of the parish to the welfare of the larger community.

These political and administrative developments coincided with and were reinforced by economic and social trends. The

15 W. Cunningham, *The growth of English industry and commerce in modern times.* Cambridge, University Press, 1912, vol. I, pp. 403 ff.

16 On the duties of the justices of the peace, see William Brown, *Astraeae abdicatae restauratio or Advice to the justices of the peace. . . .* London, 1695.

Elizabethan Poor Law had laid upon the parish the duty of providing relief for the indigent. Each parish was responsible for the maintenance of its own poor, and consequently was concerned to reduce this burden as far as possible. It was believed that this could be accomplished by arranging to employ the poor. This approach was in keeping with the contemporary desire to stimulate national prosperity by using the unemployed poor in manufactures. A favorable balance of trade was a prime desideratum of mercantilist economic policy. This came to be interpreted in the late seventeenth century as a favorable balance of employment created by trade. In other words, trade should be regulated so that only finished products would be exported and raw materials imported. Furthermore, attention should also be given to expanding the volume of trade. Increased export meant a greater employment of labor, and consequently more opportunity for investment in industry. While the central government turned its attention to questions of commercial and colonial policy, proponents of this view turned to the parish poor as an easily available labor force for the expansion of industry. Between the Restoration and the end of the eighteenth century scores of books and pamphlets were written on this subject, and many projects were suggested to deal with the problem. These proposals, as well as the optimism and eagerness with which they were put forth, are characteristic of the tendency of the period to indulge in projects. The avowed aim of the projectors was to create centers of manufacture in the form of workhouses where the poor could learn to support themselves. The first of these establishments was created at Bristol in 1696, and during the earlier eighteenth century there was a steady increase in the number of workhouses.[17]

While the enthusiastic belief in the efficacy of workhouses to deal with poverty was never realized, many of the plans and programs developed in this connection also turned attention to health problems, particularly the provision of medical care.[18] As a result of these developments there was an increasing recognition in

[17] Dorothy Marshall, *The English poor in the eighteenth century.* London, George Routledge & Sons, 1926, pp. 127-128; Karl de Schweinitz, *England's road to social security.* Philadelphia, University of Pennsylvania Press, 1943, pp. 53-55; H. R. Fox Bourne, *The life of John Locke.* New York, Harper & Brothers, 1876. 2 vols., vol. II, pp. 376-392.

[18] De Schweinitz, *op. cit.*, p. 53; A. Ruth Fry, *John Bellers, 1654-1725, Quaker, economist and social reformer.* London, Cassell and Company, 1935, pp. 5-28; John Bellers, *An essay towards the improvement of physick. . . .* London, J. Sowle, 1714; George Rosen, An eighteenth century plan for a national health service. *Bull. Hist. Med.*, 1944, *16*, 429-436; Bernard Mandeville, *The fable of the bees: or, Private vices, public benefits. With an essay on charity and charity schools:. . . .* Edinburgh, J. Wood, 1772, 2 vols., p. 220.

Britain during the eighteenth century of the need for medical assistance to certain groups in the population. It was this period, particularly the years from 1714 to 1760, which witnessed the creation, in London and the provinces, of dispensaries and general hospitals as well as hospitals for special groups of patients. The dispensary movement as well as the hospital movement found impetus chiefly in private initiative and contributions, although there was some governmental assistance in the form of legislative action. This development of private initiative coupled with cooperative action is characteristic of Britain in the eighteenth century and is to a very considerable degree related to the character of local governmental activity. While the parish officers had to assume considerable responsibilities, generally they had neither the training nor desire to perform their functions. In many ways, this very aspect of the governmental system gave increasingly greater scope to private initiative, making it necessary and possible to deal on an empirical basis with new problems as they presented themselves. Indeed, throughout this period Parliamentary action was generally undertaken on the basis of previously initiated local programs and projects.

The first institutions to provide medical care for the sick poor appeared in London. The metropolis was growing, wages were high, and workers were attracted to the city. Many of them, however, unable to establish the needed residence requirement, were ineligible for parochial relief when sick.[19] Furthermore, the two older hospitals, St. Bartholomew's and St. Thomas's, were overcrowded and unable to care for all those in need. Recognizing the problem, a group of London laymen and physicians in 1719 organized the Charitable Society in Westminster to provide for such sick persons as were unable to obtain proper care. This was the beginning of the Westminster Hospital, which was soon followed by the establishment of other institutions: Guy's (1724), St. George's (1733), London Hospital (1740).[20] About the middle of the century special hospitals were created. The influence of this

[19] The Act of Settlement of 1662 gave the parish authorities the right to remove within forty days any newcomer unable to rent a dwelling worth £10 if they believed that such a person was likely to be a burden to the parish.

[20] B. Kirkman Gray, *A history of English philanthropy*. London, P. S. King and Son, 1905, pp. 126-131. For Guy's Hospital see Samuel Wilks and G. T. Bettany, *A biographical history of Guy's Hospital*. London, Ward, Lock, Bowden and Co., 1892, pp. 52-53, 56-73. Discussion of analogous developments in Scotland and Ireland may be found in Thomas Ferguson, *The dawn of Scottish social welfare*. London, Edinburgh, Thomas Nelson and Sons, 1948, pp. 255-284, and K. H. Connell, *The population of Ireland 1750-1845*. Oxford, Clarendon Press, 1950, pp. 198-207.

trend was soon felt and paralleled outside London. By the end of the century, hospitals were to be found in most of the larger cities and towns of England, Scotland, and Ireland.[21]

But even while hospitals were being founded, it was realized that these institutions would have to be supplemented by some other kind of establishment. To fill this need the dispensary was developed. The dispensary idea may be traced to the seventeenth century, but it was not until 1769 that the first establishment of this type came into being. This was the Dispensary for the Infant Poor, opened by Dr. George Armstrong at a house in Red Lion Square, Holborn, London.[22] The opening of Armstrong's dispensary was followed in 1770 by the founding of the General Dispensary by John Coakley Lettsom, a Quaker physician, and a group of associates.[23] Following the example set by Lettsom, dispensaries sprang up in London and the provinces. From 1770 through 1792, fifteen were founded in London, and from 1775 through 1798, thirteen in the provinces.

The causes of this expansive growth were varied, but they may be considered in two major categories: socio-economic and medical-scientific. These two elements are interdependent, but as some of the social and economic factors have already been mentioned, attention will be turned briefly to the changes in medicine that made knowledge available for use. The great scientific outburst of the sixteenth and seventeenth centuries had laid the foundation for the application of science to medicine. A basis for an accurate knowledge of the structure of the human body was created through simple, critical observation by Vesalius, his contemporaries, and his successors. From this knowledge both obstetrics and surgery were already able to benefit in the eighteenth century. Equally basic, though on a more complex level, was Harvey's discovery of the circulation, which provided a firm basis for consideration of the body as a functional system. Observation and classification also

21 M. C. Buer, *Health, wealth and population in the early days of the Industrial Revolution.* London, George Routledge & Sons, 1926, pp. 257-258; Connell, *op. cit.*, pp. 274-275.

22 Ernest Caulfield, *The infant welfare movement in the eighteenth century.* New York, Paul B. Hoeber, 1931, pp. 55-58, 146-176; Gray, *op. cit.*, pp. 132-134; A. M. Carr-Saunders and P. A. Wilson, *The professions.* Oxford, Clarendon Press, 1933, pp. 72-73; Harvey Cushing, Dr. Garth: The Kit-Kat Poet. *Bull. Johns Hopk. Hosp. 1906, 17,* 1-17. G. F. Still, *The history of pediatrics.* London, Oxford University Press, 1931, pp. 417-421.

23 James Johnston Abraham, *Lettsom, his life, times, friends and descendants.* London, William Heinemann, 1933, pp. 109-110; Thomas Joseph Pettigrew, *Memoirs of the life and writings of the late John Coakley Lettsom . . . with a selection from his correspondence.* London, 1817, 3 vols., vol. I, pp. 36-38; J. C. Trent, John Coakley Lettsom. *Bull Hist. Med.*, 1948, *22*, pp. 528-542.

made possible the more precise recognition of diseases. At the same time, the possibility and importance of applying scientific knowledge for the improvement of human health and welfare were given philosophical form by Francis Bacon. These trends are already evident in the ideas and proposals of Hartlib, Winstanley, Petty, Grew, Bellers, and Mandeville, but they assumed a concrete form in the hospital and dispensary movement of the eighteenth century.

The mere accretion of medical ideas and knowledge cannot of itself assure application. Social environment and intellectual milieu must provide favorable conditions and patterns of behavior in terms of which knowledge can be put to use. Precisely this, however, characterized England during the eighteenth century, particularly during the latter part of the period. The tempo and character of economic life had been changing in England before the middle of the eighteenth century, but by comparison the industrial and agricultural changes during the latter half of the century were both rapid and revolutionary. Not without reason have these developments been designated as the Industrial and Agricultural Revolutions. These profound alterations in the economic life of the country necessarily disturbed its social structure and gave rise to a new attitude of mind toward problems of community life. Representing essentially the views of the middle classes, this distinctive ethos was characterized by two dominant facets: an insistence on order, efficiency, and social discipline, and a concern with the conditions of men. Appreciation of the social aspects and effects of disease led merchants, physicians, clergymen, and other public-spirited citizens to undertake ameliorative efforts. It is significant that the hospital and dispensary movement, the infant welfare movement, and others originated in urban centers, first in London, then in other cities and towns. Wealth, commerce, and industry were largely centered there, and at the same time it was much easier for the middle class, many of whose members were Dissenters, to make themselves felt. They fostered the growing social conscience, but it was a humanitarianism coupled with a firm belief in the sober and practical virtues of efficiency, simplicity, and cheapness.

Despite various ameliorative activities, however, the problem of the laboring poor as a fundamental social and economic question remained unsolved. By the end of the eighteenth century, augmented by agricultural and industrial change, poverty and

social distress were more widespread than ever. Nevertheless, the situation remained basically unchanged until 1834, when the drastic and revolutionary Poor Law Amendment Act was passed, ushering in a new period of thought and practice in relation to public health and social welfare. The existing Poor Law System affected the economic and administrative fabric of the state. It regulated the migration of labor and limited its mobility. While there was a widespread awareness that the existing Poor Law had to be replaced, there was little agreement on what to put in its stead. The problem of the poor remained a heavy burden for local administrators, and a subject for polemics among social reformers. But out of this ferment of thought came a new and radical approach to the treatment of the poor which was to give a uniform direction to British social and health policy throughout most of the nineteenth century.

The revolutionary changes in governmental structure and policy brought about by the Poor Law Amendment Act of 1834 were rooted in specific practical and theoretical considerations. The foremost social problem facing England during the first quarter of the nineteenth century was the organization and financing of poor relief. Assistance to the destitute was administered by 15,000 separate parishes, varying widely in size, population, and financial resources. Furthermore, to all intents and purposes, each parish was autonomous. Within this patchwork system of local authorities, annual expenditures for relief of the poor mounted steadily. From £2,000,000 in 1784 the cost climbed steadily to £8,000,000 in 1818, and still amounted to £7,000,000 in 1832 even though the price of bread had decreased by one-third since 1818. Furthermore, the leaders of the new industrialism, which was gaining momentum at the end of the eighteenth century, felt themselves hampered by the irrational restrictions of a system handed down from a pre-industrial period. Mobility of the laboring population was an essential requirement for the burgeoning industrial civilization. The labor force had to be available in adequate quantity in the places where it was most needed, and consequently the industrialists demanded a labor market open to the free play of supply and demand. This condition already existed to a considerable extent in the north of England. In the agricultural south, however, while the enclosure movement was driving the peasantry off the land, various obstacles still prevented the achievement of the desired goal. The rationalization of agriculture uprooted the

peasant laborer and undermined whatever traditional social security he had. At the same time the settlement laws tied him to his parish, so that some form of social assistance was required to relieve the unemployed or underemployed rural worker. The various forms of poor relief employed for this purpose helped to maintain a reserve of rural labor and to prevent it from moving into the towns.

Naturally, such stagnant pools of labor and the system that produced them were anathema to the new industrial middle class and to those who voiced its interests and ideals. Since the system of poor relief was alleged to be the chief obstacle to the attainment of a perfectly elastic supply of labor for industry, the remedy proposed was to do away with assistance to the able-bodied poor, and thus to free labor for the play of economic self-interest. This approach was firmly rooted in specific theoretical tenets, namely, the doctrine of philosophical necessity, the political economy of Smith, Malthus, and Ricardo, and the Benthamite philosophy of administration.

The doctrine of philosophical necessity was based on faith in a natural order of society. The world of man was believed to be as ordered and regular as the Newtonian universe. Consequently, any effort to tamper with social processes was contrary to nature. The sharpest formulation of this doctrine in relation to the poor is to be found in the social ideas of Joseph Priestley. In his opinion, "individuals when left to themselves are, in general, sufficiently provident and will daily better their circumstances."[24] Poverty and idleness ought to be governed by reason and necessity, and not by any legal provision for the poor which could act only as an incitement to idleness. If government held aloof and permitted necessity to operate unchecked, material progress would result in decreased poverty and increased education, which in turn would lead to moral improvement. Consequently, any attempt to provide relief through the Poor Law was actually an obstacle to self-help, a sin against philosophical necessity, and an impediment to progress. Instead, the poor should be compelled to fend for themselves and stimulated to help themselves by being provident.

The second strain of doctrine derived from the economic theoreticians of the new order. Political economy developed with the industrial age as the science that established and expounded the laws by which the new economic system operated. According

[24] Joseph Priestley, *Lectures on history and general policy*, p. 505, cited in Anthony Lincoln, *Some political and social ideas of English dissent 1763-1800*. Cambridge, University Press, 1938, p. 175.

to the political economists, the motive for economic activity was the powerful and pervasive force of self-interest. This motive, it was held, was guided by the force of competition and the mechanism of the market. Given free play the interests of different individuals would thus be harmonized and would lead to a system of spontaneous co-operation. This would mean more productivity, and more productivity meant more well-being. In short, as a basic principle, it was accepted that unfettered private enterprise was the mainspring of social progress. It was in this context that the Poor Laws were regarded as hampering, anti-social impediments to be removed so as to liberate the immense potential of individual initiative. Maximum self-help by individuals would do more to improve the condition of the poor than any legal assistance.

Nevertheless, this was not an ideal of freedom in a vacuum.[25] It was recognized that desirable economic ends and harmonious relations between individuals were not likely to come into being without a firm framework of law and order. In other words, if things were just left to take their course, chaos and not ordered economic activity would result. Consequently, it was necessary consciously to create the environment within which such factors as competition and the market could properly function. This leads to a recognition that the hand of the law-giver and the administrator is the invisible hand that guides men in their economic and social action. This concept is at the heart of Jeremy Bentham's legal and administrative philosophy. The problem is to devise means whereby private interests can be brought to coincide with the public interest.

These ideas found their most potent and practical expression among the group known as the Philosophic Radicals, whose great teacher and prophet was Bentham. They were a small band of intellectuals who proposed to deal with public problems on a rational, scientific basis. Their approach to specific political, economic, or social questions was rather hard-boiled, but curiously admixed with a considerable degree of naïveté. They contributed greatly to the development of the social sciences in their day, and on the basis of these researches called for a whole series of reforms. The schemes for which this group of highbrows labored so mightily included parliamentary reform, free trade, law reforms, educational reforms,

25 For a lucid exposition of these positions see Lionel Robbins, *The theory of social policy in English classical political economy*. London, Macmillan and Co., 1952; also *Jeremy Bentham's economic writings*. Critical edition . . . by W. Stark. New York, Burt Franklin, 1952, vol. I, pp. 223-273.

and birth control. Even though they were a small group with little emotional appeal (in fact some of the group were heartily disliked by their contemporaries), they managed to put through a large part of their program. Directly or indirectly, the Philosophic Radicals exercised a profound influence on their contemporaries; and many of the far-reaching changes in the English constitution as well as in economic and social legislation between the 1820's and the 1870's were reforms of the kind for which they had argued and fought.

Their opportunity came in 1832. Almost the first action of the reformed Parliament was the appointment of a Royal Commission to inquire into the operation and administration of the Poor Laws. Through the appointment of Edwin Chadwick, an ardent Radical and favorite disciple of the master, first as Assistant to the Commission and later as a Commissioner, Benthamite thought was brought to bear directly on the Poor Law inquiry. In Chadwick's mind, Benthamism and classical political economy were fused to produce a dynamic social philosophy ready to be urged to action by propitious circumstances. That Chadwick did not shirk his opportunities is evident even from a superficial examination of the history of nineteenth century England. As *The Times* put it ironically in 1854:

> Future historians who want to know what a Commission, a Board whether working or Parliamentary, a Report, a Secretary of State or almost any other member of our system was in the nineteenth century, will find the name of Chadwick inextricably mixed up with his inquiries. Should he want to know what a job was in those days he will find a clue to his researches in this ubiquitous name . . . Ask—Who did this? Who wrote that? Who made this index or that dietary? Who managed that appointment, or ordered that sewer, and the answer is the same—Mr. Edwin Chadwick.[26]

The Report of the Commission appeared early in 1834, having been written by Chadwick and his friend Nassau Senior, the economist.[27] The Poor Law Amendment Act which became law on August 14, 1834 incorporated the principles of the Report and implemented them. The provisions of the Act may be divided into two parts, those concerning the principles on which relief was to be administered, and those dealing with the new administrative ma-

[26] *The Times*, 8 July 1854, cited in S. E. Finer, *The life and times of Sir Edwin Chadwick*. London, Methuen & Co. Ltd., 1952, pp. 1-2.

[27] Sidney and Beatrice Webb, *English poor law history*: Part II: *The last hundred years*, 1929, 2 vols., vol. I, pp. 47-103, Finer, *op. cit.*, pp. 39-49, 69-95; Marian Bowley, *Nassau Senior and classical economics*. New York, Augustus M. Kelley, Inc., 1949, pp. 282-334. Thomas Mackay, *A history of the English poor law, Volume III. A.D. 1834-1898*. London, P. S. King & Son, 1904, pp. 37-46, 52-156.

chinery it created. The principles on which relief was to be granted were openly deterrent. No able-bodied persons and their families were to be given assistance except in a well-regulated workhouse. In addition, the lot of the able-bodied pauper was to be made "less eligible" or, in other words, more miserable than that of the worst situated laborer outside the workhouse. On the administrative side the outstanding feature was the endeavor to secure centralization, uniformity, and efficiency. In place of the parish officers, the Act provided for three paid Government Commissioners and a paid secretary who would constitute a central Poor Law Commission. This body would issue orders and regulations to guide local poor law officials in the administration of the law. The unit of local administration was to be the union of parishes, and in each union the law would be carried out by an elective Board of Guardians.

The significance of the New Poor Law as a focal point of social change can hardly be overestimated. The immediate objective of the Act was to reduce the poor rates, but its broader aim was the creation of a free labor market as a precondition for investment. The market economy was asserting itself and clamoring for human labor to be made a commodity. This end was achieved, and it is no exaggeration to say that the social history of the nineteenth century was determined by the logic of the market system after it was established by the poor law reform of 1834. It was no accident that men began to explore the problems of community life with a new anguish of concern in the following decades. For the fact is that the setting up of the labor market simultaneously broached the larger question of how to organize life in a complex industrial and urban society.

A major aspect of this question was the organization of the community to protect its health. The problem of the public health was inherent in the new industrial civilization. The same process that created the market economy, the factory, and the modern urban environment also brought into being the health problems which made necessary new means of health protection and disease prevention. It is significant that public attention was first attracted to these problems at Manchester, the first industrial city.[28] Beginning in 1784, a series of epidemic fevers brought sharply to the notice of

28 B. L. Hutchins and A. Harrison, *A history of factory legislation*. 2d ed. London, P. S. King and Son, 1911, pp. 7-13; M. W. Thomas, *The early factory legislation*. Leigh-on-Sea, Essex Thames Bank Publishing Co., Ltd., 1948, pp. 8-9; Leon S. Marshall, The emergence of the first industrial city. Manchester, 1780-1850, in *The cultural approach to history* edited by Caroline F. Ware. New York, Columbia University Press, 1940, pp. 140-161. George Rosen, John Ferriar's "Advice to the Poor," *Bull. Hist. Med.*, 1942, *11*, 222-227.

the community the significance of factories and congested dwellings as providing conditions in which such diseases could flourish and spread. During the winter of 1795 the spread of typhus alarmed and terrified the inhabitants and led a group of wealthy townsmen, magistrates, and physicians, among them Thomas Percival and John Ferriar, to form a voluntary Board of Health. Despite its multifarious activities and recommendations, however, opposition to and neglect of its program rendered the Board ineffectual. At the same time, as the nineteenth century progressed, the growth of unhealthy conditions far outran attempts at improvement.

This situation was generally true throughout the country. More and more England lived in towns and worked in factories, and as this new way of life spread, health conditions deteriorated, leaving far behind any voluntary, piecemeal efforts to cope with the problem. Thus, between 1801 and 1841 the population of London leaped from 958,000 to 1,948,000; between 1801 and 1831 that of Leeds expanded from 53,000 to 123,000, and of Huddersfield from 15,000 to 34,000. This rapid growth was soon reflected in mounting death rates. Between 1831 and 1844, the mortality rate per thousand population of Birmingham rose sharply from 14.6 to 27.2, of Bristol from 16.9 to 31, of Liverpool from 21 to 34.8, and of Manchester from 30.2 to 33.8.[29]

Unconsciously, the creation of the Poor Law Commission in 1834 also brought into being the instrument which was to open up fully the question of the health of the population and to provide the means for dealing with this problem. Chadwick was appointed Secretary to the Commission, and while his interests and activities were directed at first to the limited goal of reducing the poor rates, he had a much deeper sense of the causes of pauperism. Among the members of the Royal Commission of Enquiry into the Poor Laws, he was the only one to investigate the health of the pauper population.[30] Furthermore, he had a concept of preventive social action applicable to the problems of poverty and disease. Around 1824 Chadwick had become acquainted with Southwood Smith and Neil Arnott, two medical men who were also friends and disciples of Bentham.[31] "From Arnott and Smith," he wrote in 1844, "I derived a strong conviction of the superior importance of the

[29] G. T. Griffith, *Population problems of the age of Malthus*. Cambridge University Press, 1826, p. 186.

[30] Finer, *op. cit.*, p. 69.

[31] *Ibid.*, p. 10.

study (as a science) of the means of *preventing* disease, and I was the better enabled to perceive some of the important relations of the facts expressed by vital statistics which were brought before me in my public investigations."[32] Recognizing that pauperism was in numerous instances the consequence of disease for which the individual could not be held responsible, and that disease was an important factor in increasing the burden of the poor rates, Chadwick concluded that it would be good economy to undertake measures for the prevention of disease. In a letter to Southwood Smith around 1848, Chadwick stated his position frankly.

> The sanitary measures, [he wrote], had strictly and exclusively an official origin . . . . they arose as a consequence, though an indirect and perhaps an accidental one of measures directed by Government in 1832, viz. the Enquiry into the administration of the Poor Laws; in the course of some investigations with the view to discriminate the causes of pauperism, excessive sickness, and its preventible causes were suggested by circumstances which appeared in the course of that enquiry and are noticed as one of the topics of examination in my report, laid before Parliament with others . . . . afterwards, under the Administrative Commission, in 1838 when a heavy amount of claims appeared as a consequence of the prevalence of an epidemic, I felt it my duty to call the attention of the Commissioners to the preventible nature of the causes of a large proportion of these cases, and recommended a special investigation of them . . . .[33]

This approach to the problem of poverty and disease was reinforced by Chadwick's deep-rooted conviction that health was affected for better or worse by the state of the physical and social environment. In fact, before the crucial study of the sanitary condition of the population was undertaken, he circulated a letter of instruction to medical officers pointing out the need "to ascertain the existence and extent of the visible and removable agencies promoting the prevalence of such disease as are commonly found connected with defects in the situation and the structure or internal economy or the residences of the labouring classes."[34] Furthermore, Chadwick saw clearly that accurate statistical information could be exceedingly important in disease prevention. He tried to set up a Bureau of Medical Statistics in the Poor Law Office, and when the Registration of Births and Deaths Act was passed in 1836, he saw immediately and listed the uses to which it could be put. This list illustrates how, even at this early date, problems of pecuniary

32 *Ibid.*, p. 158.

33 *Ibid.*, p. 157.

34 *Report to Her Majesty's Principal Secretary of State for the Home Department, from the Poor Law Commissioners, on an inquiry into the sanitary condition of the labouring population of Great Britain; with appendices.* London, W. Clowes, 1842, p. XIV.

profit, disease prevention, environmental causation, and governmental action were all intimately interwined in his thought. Thus, he thought the Act could make possible:

> (a) The registration of the causes of disease, with a view to devising remedies or means of prevention.
>
> (b) The determination of the salubrity of places in different situations with a view to individual settlements and public establishments.
>
> (c) The determination of comparative degrees of salubrity, as between occupation itself and occupation in places differently circumstanced, in order that persons willing to engage in insalubrious occupations may be the more effectually enabled to obtain adequate provision for their loss of health.
>
> (d) The collection of data for calculating the rate of mortality, and giving safety to the immense mass of property insured, so as to enable every one to employ his money to the best advantage for his own behalf, or for the benefit of persons dear to him; and that without the impression of loss to anyone else.
>
> (e) The obtainment of a means of ascertaining the progress of population at different periods, and under differing circumstances.
>
> (f) The direction of the mind of Government and of the people to the extent and effects of calamities and casualties; the prevention of undue interments; concealed murder; and deaths from culpable heedlessness or negligence.[35]

It is within this context that the fundamental document of modern public health, the *Report . . . on an inquiry into the Sanitary Condition of the Labouring Population of Great Britain,* appeared in 1842. The report proved beyond any doubt that disease was related to filthy environmental conditions, due to lack of drainage, water supply, and means for removing refuse from houses and streets. Attention was further focused on these problems by Chadwick's adherence to the theory that epidemic fevers were due to miasmas arising from decaying animal and vegetable matter. "The defects which are the most important," wrote Chadwick, "and which come most immediately within practical legislative and administrative control, are those chiefly external to the dwellings of the population and principally arise from the neglect of drainage."[36] Thus, the problem of the public health was reoriented by definition. It was declared to be an engineering rather than a medical problem. As Chadwick saw it, what was needed was an administrative organ to undertake a preventive program by

[35] Edwin Chadwick, *The health of nations. A review of the works of Edwin Chadwick. With a biographical dissertation, by Benjamin Ward Richardson.* London, Longmans, Green and Co., 1887, 2 vols., vol. I, pp. XLIII-XLVI, 77-78.

[36] *Report . . . on an inquiry into the sanitary condition of the labouring population. . .,* p. 25.

applying engineering knowledge and techniques in an efficient and consistent manner. In the *Sanitary Report,* he stated his position bluntly and without qualification. "The great preventives," he wrote, "drainage, street and house cleansing by means of supplies of water and improved sewerage, and especially the introduction of cheaper and more efficient modes of removing all noxious refuse from the towns, are operations for which aid must be sought from the science of the Civil Engineer, not from the physician, who has done his work when he has pointed out the disease that results from the neglect of proper administrative measures, and has alleviated the sufferings of the victims."[37] It is clear, however, that Chadwick recognized the need for a physician to point out the location, nature, and course of infection in a given area, and in line with this idea suggested in the *Report* the appointment of "a district medical officer independent of private practice, and with the securities of special qualifications and responsibilities to initiate sanitary measures, and reclaim the execution of the law."

Chadwick's *Report* led to the Royal Commision on the Health of Towns, appointed by Sir Robert Peel in 1843. Its report was to public health what the Poor Law Report of 1834 was to public assistance, and, as in the earlier instance, Chadwick played the leading rôle in the work of the Commission. He drafted the major part of the report issued by the Health of Towns Commission, and the administrative and operational proposals were his own. In view of Chadwick's Benthamite orientation and his experience with the Poor Law Commission, it is not surprising that when the first central health department, the General Board of Health, was created in 1848, it followed the model of the Poor Law Commission.

The creation of the General Board of Health is a major landmark in the history of public health. Despite its brief existence and the handicaps under which it operated, the Board achieved much. However, it is not our intention to examine in detail the activities of the Board or the further immediate development of public health in England. The changes initiated in the 'thirties and 'forties were underlined and carried further during the following period from 1848 to the present. At the same time, there pushed into the foreground new currents of thought and practice, of which some were hitherto only latent, while others appeared in response to new problems. The two strains of *laissez-faire* and social regulation, which were present in Bentham's thinking and

[37] *Ibid.,* p. 341.

were applied by Chadwick to public assistance and public health, persisted both in theory and practice throughout the century, but the relative emphasis and significance given to these approaches shifted more and more to social regulation.

"How quaint the ways of Paradox!" observed Sir William Gilbert, and nowhere is this comment more apposite than in the development of social action in relation to public health. The paradox has two aspects, one medical, the other social and political. The former concerns the rôle of medicine in the development of public health. Objective analysis of the beginnings of the public health movement in England around the middle of the last century leads to the conclusion that medicine played a secondary part in this process. The impulse to sanitary reform did not come from the medical profession, even though some physicians played a significant part in calling attention to the community problem of ill-health. Furthermore, medicine had little real knowledge to contribute toward a solution of the major problem, which concerned the transmission of communicable disease. Contagionists fought anti-contagionists, but the bitter medical controversy had little effect on the establishment of public health legislation and administration. Indeed, it is noteworthy that the early public health program was based on a structure of erroneous theories, and while it hit upon the right solution, it was mostly for the wrong reasons. (Parenthetically, the rôle of these theories in the evolution of public health illustrates strikingly what I have described as the rôle of negative factors in the development of positive advances, or what Galdston has characterized as the creative function of the erroneous idea.) [38] Broadly speaking, what happened was that the builders of modern public health, accepting certain postulates of economic and social policy, established institutional forms into which later more accurate and effective medical knowledge could be fitted. Significant instances of such forms are the supervision of local health services by a central authority, and the post of the health officer.

Consideration of these institutions, however, goes directly to the heart of the political and social paradox. It is indeed a striking paradox in modern English history that the introduction of economic freedom in the nineteenth century, far from doing away with the need for governmental intervention, control, and regula-

[38] George Rosen, Negative factors in medical history. A preliminary inquiry into their significance for the dynamics of medical progress. *Bull. Hist. Med.*, 1938, *6*, 1015-1019. Iago Galdston, Mesmer and animal magnetism, *Ciba Symposia*, 1948, *9*, 832-837 (see p. 833).

tion, eventually led to an enormous increase in the administrative functions of the state. The 'thirties and 'forties saw an outburst of legislative activity abolishing restrictive regulations and social obligations prevalent before the industrial revolution; but even while certain forms of social regulation were being discarded, others were replacing them. While the industrial revolution was still in its infancy, Robert Owen had foreseen the need for state action to curb some of the consequences of economic freedom. "The general diffusion of manufactures throughout a country," he wrote in 1815, "generates a new character in its inhabitants; and as this character is formed upon a principle quite unfavorable to individual or general happiness, it will produce the most lamentable and permanent evils, unless its tendency be counteracted by legislative interference and direction."[39] Owen's warning was soon realized and while the New Poor Law created a system of labor incentives for the new class of factory workers, factory laws and health laws were laying the foundation for centralized authority to promote human health and welfare.

In fact, the question of health serves as a focal point around which the doctrines of economic freedom and political liberalism can be seen in various stages of modification. This transformation did not arise simply from the growth of humanitarian sentiment or of social conscience. Legislation on health and sanitation resulted from a variety of forces within the social and economic order. It resulted less from a concern for the welfare of the poor than from a growing realization after 1850 that epidemic disease caused by defective sewerage or infected food was a problem of the entire community. Furthermore, there was an increasing awareness that the cost involved was a form of social waste that could be eliminated. Thus, by 1859, Edwin Chadwick, the architect of the New Poor Law, which had been created in order to bring into being a highly competitive labor market and to enforce competition, was advocating that governmental authorities go into business, and that such enterprises be organized on a monopolistic rather than a competitive basis.

> The earlier politico-economical doctrines as to competition [he said] must now receive considerable modifications. The waste and possible saving of capital indeed admit of as little dispute as do cases of the waste of mechanical power, or the direction of the means of economy. To the questions sometimes put to me, where I would stop in the application of my principle,

[39] Robert Owen, *A new view of society and other writings* (Everyman's Library Edition). London, J. M. Dent; New York, E. P. Dutton, 1927, p. 121.

I am at present only prepared to answer, 'where waste stops'; and that public intervention in whatever form for the prevention of waste may stay where it ceases to be charged upon the public, which must be a matter of inquiry in each case involving the question where the application of the principle needs authoritative intervention, or where it may be best left to voluntary means guided by an advanced intelligence.[40]

A decade later, in 1870, the Poor Law Board seriously considered the establishment of a system of free medical advice to all wage-earners in England and Wales.[41] The annual report for 1869-70 discussed "how far it may be advisable, in a sanitary or social point of view, to extend gratuitous medical relief beyond the actual pauper class . . . to the poorer classes generally." In the early 'eighties, Joseph Chamberlain described health progress in Birmingham in a letter to Morley. "Putting aside personal compliments," he wrote, "what are the facts? A saving of seven per thousand in the deathrate—2,800 lives per annum in the town. And as five people are ill for everyone who dies, there must be a diminution of 14,000 cases of sickness, with all the loss of money, pain, and grief they involve."[42] At the same time, while the organization of the labor market established by the New Poor Law was maintained relatively intact, protective legislative action improved working conditions in mines and factories and mitigated the harshness of the early *laissez-faire* system. This legislation was not extensive enough to throw the system out of gear. In fact, as compared with the stigma of the poor law and its workhouse, factory life was a lesser evil. Nevertheless, these laws helped to undermine the prevailing social philosophy. Furthermore, the new class of industrial workers, taking seriously the democratic implications of liberalism in terms of human rights and human dignity, and recognizing the effectiveness of group solidarity, organized themselves in trade unions and political parties, refused to compete against one another, and took action to secure for themselves various kinds of social services, including medical care.

These have been some of the factors significantly involved in the process by which since the beginning of this century the health of the English people has become a major concern of government,

40 Edwin Chadwick, Economical results of different principles of legislation and administration in Europe . . . *Journal of the Statistical Society of London*, September, 1859, p. 408.

41 Sidney and Beatrice Webb, *The state and the doctor*. New York and London, Longmans, Green and Co., 1910, p. 7; *Twenty-second Annual Report of the Poor Law Board*, 1869-70, p. III ff.

42 J. L. Garvin, *The life of Joseph Chamberlain*. London, Macmillan, 1932, vol. 1, p. 385.

and the provision of services for the promotion and maintenance of health a fundamental part of an impressive edifice of social services. This summary presentation is enough to indicate, however, how the contemporary state of public health has been and is being influenced by changing economic and social policy.

This brings me back to the point from which I started: the influence of economic and social policy on the development of public health. If my interpretation of the history of public health is sound, and I want to emphasize that this is an essay in interpretation, then certain consequences follow. First, there can be no real comprehension of the history of public health at any period without a thorough understanding of the political, economic, and social history of that period in its relation to the contemporary public health situation. This is not to disparage the medical and scientific elements in the historical process, but simply to indicate the great, and in many cases overriding, importance of the non-medical factors in creating the structure and the channels within which the former may operate. Secondly, the task of the historian must be to investigate and to demonstrate how economic, social, medical, and scientific events intertwine and interact to create specific public health developments. I have tried to demonstrate this process of interaction at different periods in English history, and to show how success or failure in achieving public health aims was related to conditions under which such activity was pursued. It must be emphasized that the same approach will be found equally applicable to the history of public health in other countries and other parts of the world.[43] At the same time, while certain general trends may be found, for example, to apply to all of Europe and North America, the historian in dealing with public health in a specific country will have to discover and show how and under what circumstances the general trend manifests itself, and wherein there are differences.

It has not been possible to do more here than to present and illustrate a problem. But if this analysis should happen to make those interested in the development of public health more conscious of the problem and what it involves, it will have achieved its purpose.

[43] See, for example, George Rosen, Cameralism and the concept of medical police. *Bull. Hist. Med.*, 1953, 27, 21-42.

Some Eighteenth Century Experiments in Embalming

JESSIE DOBSON*

THE art of embalming or preserving the bodies of the dead has an origin which is difficult to trace. It seems to have been practised in Egypt at least two thousand years before the birth of Christ but there is evidence that it was introduced into that country, possibly from Ethopia, at an even earlier period. Other writers have dealt exhaustively with the various methods employed in different parts of the world, from the lengthy and expensive technique required for members of the more wealthy Egyptian families, to desiccation in hot sand, or enveloping in goat skins and incarceration in caves. In more recent times, however, the process of embalming has been employed only in the case of royal personages and others whose bodies, for purposes of 'lying in state' or other reasons, it was desirable or requisite to preserve in as life-like a condition as possible. The technique employed in 1307 for the embalming of King Edward I of England was so effective that when his tomb was opened, about five hundred years afterwards, the body was found to be in an excellent state of preservation.

In the eighteenth century, as a consequence of the demand for more accurate knowledge of anatomy as part of the training of medical men, the problem of preserving the bodies used for dissection was a matter of first importance. William and John Hunter were probably the first to give systematic classes in dissection and they, as well as some of their pupils, tried to perfect a method of preservation that would overcome their difficulties in this field. In three instances, the circumstances were such that the subjects of these experiments were still in existence a hundred years later.

The first specimen with which this account deals is that known as the 'Manchester Mummy.' The year 1728 marked the birth of John Hunter at Long Calderwood and of Charles White, one of Manchester's greatest surgeons. There is no need here to go into the details of White's distinguished career, for these have already been admirably dealt with by Professor Cullingworth, Dr. E. M. Brockbank, Professor Adami, and Dr. E. Bosdin Leech. Some incidents of his life must, however, be recalled. In 1748 he went to Lon-

* Recorder of the Museum, Royal College of Surgeons of England, London, England.

don to attend William Hunter's classes in anatomy and there met John Hunter, also attending the classes for the first time and helping his brother to prepare the dissections. The friendship between White and John Hunter thus begun ended only with the latter's death in 1793. Charles White, though his main occupations were surgery and obstetrics, never lost his interest in anatomy and indeed, no doubt inspired by John Hunter, built up a natural history collection of his own, which included some 'curiosities.' Perhaps the most interesting of these was the preserved body of Miss Hannah Beswick—the 'Manchester Mummy.' This lady was born in 1688, the daughter of John Beswick of Failsworth, a man of considerable wealth, most of which his daughter inherited. Charles White was her medical adviser for many years before her death in February 1758. The accounts that have been written about the events immediately subsequent to Miss Beswick's death are full of inaccuracies and contradictions. It has been stated that Charles White was in debt to her for a considerable sum, which he would have been obliged to repay after her funeral and for this reason he embalmed the body to avoid the difficulties the repayment would have involved. Alternatively, it is stated that White had done so much to alleviate Miss Beswick's sufferings that she made him a bequest, estimated by some to have been not less than £25,000, on condition that "she should be embalmed as perfectly as the resources in that art of London and Paris could accomplish," for she dreaded the possibility of being buried alive. This seems to have been mere conjecture, for there is no such bequest mentioned in her will, nor any desire expressed that her body should be embalmed. Others say that Charles White was appointed executor and was to receive the sum of £400 for funeral expenses, any surplus to be disposed of as he desired, and that the embalming was done so that he could pocket the whole amount. The will definitely states, however, that Mary Graeme and Esther Robinson should act as executrices and this duty they carried out, as a note, dated 4 February 1758, on a codicil to the will testifies. The sum of £400 was certainly left for the expenses of Miss Beswick's funeral, but the will definitely states that the executrices could dispose of any surplus "discretionally amongst her Father's relations without giving account to any person for all or any part." Charles White, therefore, seems to have been much maligned in this matter, for the only sum he received as a bequest in the will was £100, and this no doubt was as a repayment for the services required of him in

the same document in the matter of arranging apprenticeships for many of the testatrix's relatives and for investing and distributing the interests on certain trust funds according to her wishes. The fact remains, however, that Miss Beswick's body *was* embalmed, presumably by Charles White and most probably by methods recommended by William and John Hunter, and it remained in his possession until his death on February 20, 1813, at Sale Priory, near Manchester. Thomas de Quincy, who was born in Manchester in 1785, was taken to see Charles White's museum when he was a child and in his "Autobiography" he records the fact that the mummy had been "placed in a common English clock-case, having the usual glass face; but a veil of white velvet obscured from all profane eyes the silent features behind." He also relates that in White's museum was the "superb-looking" skeleton of a man named Higgins, a highway robber and sheep-stealer who settled for a time in Knutsford and married a respectable woman "whom he maintained very handsomely by his robberies." In 1767, Higgins, who was then living near Bristol, was arrested for burglary and was tried, convicted, and executed at Carmarthen on November 7th. His body was handed over to the anatomists and the skeleton prepared by William Cruikshank and Charles White, who kept it for his museum. After Charles White's death in 1813, the mummy, which had been stored in an attic at Sale Priory, was given, with the rest of his collection, to the Manchester Natural History Museum which was housed first in King Street and later in Peter Street. When in 1868 it was decided to close this museum, the mummy was buried in Harpurhey Cemetery "without stone or tablet to indicate the spot." In the Manchester Museum there still exists the table on which the mummy was displayed.

Unfortunately, no records exist to give the process used by White, but most probably it was similar to the one used in 1775 by William Hunter and William Cruikshank for the embalming of Mrs. van Butchell. This lady, only thirty-six years old when she died, was the first wife of Martin van Butchell, the eccentric dentist and truss-maker who had been a pupil of John Hunter. As in the case of the 'Manchester Mummy,' the reason for the embalming remains unknown. It has been suggested that a clause in the marriage settlement, granting him the disposal of some property while his wife *remained above ground,* may have been the motive, or, more charitably, it may have been the result of his great af-

fection for her, as the following epitaph from a contemporary newspaper would seem to imply.

Epitaph on Mrs. Vanbutchel
whose remains, preserved by a curious and newly invented method of embalment, are the object of her fond husband's daily attention.

Here, unintombed, Vanbutchel's comfort lies,
To feed a husband's grief, or charm his eyes;
Taintless and pure her body still remains,
And all its former elegance retains.
Long had disease been preying on her charms,
Till slow she shrunk in Death's expecting arms;
When Hunter's skill in spite of Nature's laws,
Her beauties rescued from Curruptions jaws;
Bade the pale roses of her cheek revive
And her shrunk features seem again to live:
—Hunter, who first conceived the happy thought,
And here at length to full perfection brought.
O! lucky Husband! Blest of Heav'n
To thee the privilege is given,
A much loved wife at home to keep,
Caress, touch, talk to, even sleep
Close by her side, when e'er you will
As quiet as if living still:
And, strange to tell, that fairer she,
And sweeter, than alive should be;
Firm, plump and juicy as before
And full as tractable, or more—
Thrice happy mortal! Envied lot;
What a rare treasure thou hast got!
Who to a woman canst lay claim
Whose temper's every day the same!

That the method or the purpose of the embalming was novel seems to be apparent from another epitaph, in Latin, that appeared in *The Gentleman's Magazine* in January 1793. It commences "In reliquas Mariae Vanbutchell novo miraculo conservatas et a marito suo superstites cultu quotidiano adoratas." William Hunter is referred to as "Vir egregius, artificii, prius intentati inventor idem, et perfector." An account of the method he used is to be found in the notes of his lectures, taken by one of his students in the year 1775/6 and preserved in the Library of the Royal College of Surgeons. The description of the process is too long to reproduce in full, but it involves three stages, the first being the injection of turpentine and vermilion "to fill the Arteries and Veins and even go further to produce extravasation to every part of the Body, i.e., til the face and all the flesh swell which will be a proof of extravasation and the more there is so much the better." The body was now left for several hours before the commencement of the second

stage during which the viscera of the thorax and abdomen were removed and placed in water. Hunter observes that "the whole viscera when all the Blood is press'd out go into a very little bulk, even the Liver will lose vastly of its bulk and in short the whole viscera will come into a small compass when they are well clean'd and put into dry cloths; you are then to go to the trunk of the Body and empty it of Blood as well as you can and press the blood out from the Face, Hands etc. as well as Arms, and the more Blood is press'd out the better." The bladder and rectum are then to be emptied, all these operations to be done with great care. Hunter recommends that "instead of being only 10 minutes about this Process you must be ½ an Hour or an Hour about it." All parts are then to be washed in spirits of wine before proceeding to the third stage which consisted in the injection of the body a second time, the viscera also if it should be considered necessary. Hunter did not remove the brain for separate treatment since he considered it would be sufficiently preserved by the general injection. The viscera were then replaced in the body and the cavities filled up completely with a mixture of camphor, nitre, and resin. Having sewn up the body and filled the outlets with camphor, it was then well washed, thoroughly dried, and rubbed with fragrant oils. The box containing the body was filled up to half the depth with plaister of Paris to absorb the moisture. Hunter concludes by saying:

> This Body, Gentlemen, yet promises exceedingly well, nor do I see any great improvement to be made; a number of experiments must be made before I embalm any other Body, such as finding the exact proportion of moisture Paris Plaister will take up, etc. but at present I know of no other Process at all useful and considering the trouble you must have during all these Processes now laid down, you ought not to undertake it under 100 Guineas.

According to a Memorandum written by Martin Van Butchell himself, a copy of which is preserved in one of the Donation Books of the Museum of the Royal College of Surgeons, he himself took part in the proceedings. The document is in the form of a diary, from which the following entries are taken:

> 14th. January 1775. At half past two this morning my Wife died. At eight this morning the statuary took off her face in plaister. At half past two this afternoon Mr. Cruikshanks injected at the crural arteries 5 pints of Oil of Turpentine mixed with Venice Turpentine and Vermilion.
>
> 15th. At nine this morning Dr. Hunter and Mr. Cruikshanks began to open and embalm the body of my Wife. Her diseases were a large Empyema of the left lung (which would not receive any Air), accompanied with Pleuro-

pneumony, and much adhesion: the right lung was also beginning to decay, and had some Pus in it. The spleen hard and much contracted; the Liver diseased called Rata Malpigi. The stomach very sound, the kidneys, uterus, bladder and intestines in good order.

17th. I opened the abdomen to put in the remainder of Powders.

18th. Dr. Hunter and Mr. Cruikshanks came at 9 this morning and put my wife into the Box on and in 130 lb. weight of Paris plaister at 18d. a bag. I put between the thighs three Arquebusade bottles, one full of Camphorated Spirits very rich of the Gum; one containing 8 oz. of Oil of Rosemary; and in the other 2 oz. Oil of Lavender.

11th. February. I unluted the glasses to clean the face and legs with Spirits of Wine and Oil of Lavender.

12th. Dr. Hunter came to look at the neck and shoulders.

St. James's Chronicle, O.S. 21, 1775.

VANBUTCHELL (not willing to be unpleaſantly circumſtanced, and wiſhing to convince ſome good Minds they have been miſinformed) acquaints the Curious, no Stranger can ſee his embalmed Wife, unleſs (by a Friend perſonally) introduced to himſelf, any Day, between Nine and One, *Sundays* excepted.

Sign'd. Vanbutchell

FIG. 1. A photograph of the original card which is in the possession of the Royal College of Surgeons of England.

A vast amount of interest was taken in this 'mummy' which Martin Van Butchell kept in his own house. William Hunter brought many visitors, including Sir Thomas Wynn and his lady, Sir John Pringle, Dr. Heberden, Dr. Watson, Dr. Solander, Mr. Banks, and many other Fellows of the Royal Society. In fact, so pressing were the requests to see this curiosity that Van Butchell circulated a notice (Fig. 1) restricting the hours and conditions for viewing the body which apparently remained in his house even after his remarriage. He died on October 30, 1814 and on August 24th of the following year, the Board of Curators of the Royal

College of Surgeons received a letter from his son, Mr. E. M. Van Butchell, offering to the Museum the embalmed body, which was accepted and placed in what was known as the Curio Room next to the mummy prepared by John Sheldon, also in the year 1775.

John Sheldon, who was born on July 6, 1752 in Tottenham Court Road, was apprenticed to Henry Watson, a well-known anatomist of that period. After gaining the Diploma of the Surgeon's Company on November 2, 1775, Sheldon took a post on the staff of the Lock Hospital. One of his patients was a Miss Johnson, a young woman of about twenty-four years of age who was suffering from phthisis. He apparently became very much attached to her and before she died, it is said that she asked him to preserve her body. This he did, afterwards removing the embalmed and injected body to his own house.

In August, 1784, that is, nearly ten years after the mummy was first prepared, Monsieur B. Faujas Saint-Fond, Professor of Geology in the Museum of Natural History in Paris, visited London and in his *Voyage en Angleterre, en Ecosse, et aux Iles Hebrides,* published in Paris in 1797, he mentions that he visited Sheldon and saw his museum which, he says, contained "a great variety of curious preparations." Of the mummy, Saint-Fond observed that "It occupied a distinguished place in the chamber where this anatomist usually slept. . . . She had fine brown hair and lay extended as on a bed. The glass was lifted up, and Sheldon made me admire the flexibility of the arms, a kind of elasticity in the bosom, and even in the cheeks and the perfect preservation of the other parts of the body. Even the skin partly retained its colour, though exposed to the air. . . . He had injected several parts of it with strong spirits of wine, saturated with camphor, mixed with a small quantity of turpentine. The skin was prepared and tanned with finely powdered alum, rubbed on by hand. The intestines were taken out and covered with a varnish composed of camphor mixed with resin and, in order to imitate the natural tint of the skin of the face, he injected the carotid arteries with a coloured substance." Saint-Fond asked who the lady was whose remains had been preserved with such care, and Sheldon replied, without any hesitation: "It is a mistress whom I tenderly loved. I paid every attention to her during a long sickness and, a short time before her death, she requested that I should make a mummy of her body, and keep her beside me—I have kept my word to her."

A somewhat different story was told, however, by Mrs. Sheldon who, after the death of her husband on October 8, 1808, wrote to the Board of Curators of the Royal College of Surgeons offering them the mummy. Some years later, William Clift, the Conservator of the Museum, applied to Mrs. Sheldon for further particulars about this interesting specimen and her reply, dated September 7, 1816, states that the mummy was of "an unfortunate woman who died in the Lock Hospital I should think so long since as 1774 or 1775. Mr. Sheldon and another student of that Charity were *kind* to her. She in return left her Body to them for Dissection. They cast lots for it. Mr. S. got it, and embalmed it. I have heard him say it cost him much trouble as well as expense, but it had answered his Wishes, as he thought she would remain in her present state for Centuries. . . . The mode of preserving it I do not know, but that much Camphor was used; for I recollect putting a little favourite Bird in the room in which the Case stood that contained the Body; in the morn the Bird was found dead, which Mr. Sheldon attributed to the smell of the camphor. I recollect Mr. S. preserved in the same manner, a little Negro Foetus of seven months, but some one stole it who came to see the other mummy. I had forgot to say that I know this much, that all the Arteries and Veins were filled by injection and that Spirits of Wine was used as well as Camphor. That the Heart and Intestines were taken out, injected and replaced, as was the Brain. But I question whether some of those who saw her did not deal roughly: as she was on the first and for many years, sewn up, and some one cut the Threads to inspect the Inside."

On September 29, 1838, Mr. Clift received a visit from William Sweeting, a nephew of John Sheldon, and this gentleman stated that in his opinion the embalmed body was that of Sarah Stone, a medical artist who had worked both for Sheldon and Cruikshank. Clift remarked that the story that the body was that of Sheldon's patient, Miss Johnson, originated with Mrs. Sheldon "who could only know what was told her!"

These were by no means the only experiments of this kind. John Hunter himself must have had no little experience in the technique, for he was engaged to embalm the body of the Earl of Moira in 1793. The operation was carried out by Everard Home and by John Doratt, one of Hunter's pupils, under the direct supervision of Hunter and is interesting because of the variation of the process from that used by his brother. Doratt's manuscript giv-

ing the details of the technique is in the possession of the Royal College of Surgeons and the procedure was as follows. After removal of the thoracic and abdominal viscera, the trunk was well washed with cold lime water and afterwards soaked in rectified spirit of wine. The viscera, having been cleaned, were treated in the same way and then returned to the body cavity which was then filled with spices and alum. "The integuments were then closely drawn together and strongly sewn with twine well waxed." The brain was removed and "was divided in many parts by small incisions or deep punctures, and a considerable quantity of friar's balsam poured into them; it was carefully replaced within the cranial cavity, well covered with the balsam, so as to envelop the whole mass, the scalp well drawn over the whole cranium, and closed, by being closely sewn with twine well waxed. The mouth and throat were crammed with the spices wetted with the balsam, as also the nostrils." The limbs were then rolled in waxed cloth and the whole body also enveloped.

At about the same time, Matthew Baillie, nephew of the Hunters, was making similar experiments. His uncle William's method, he says, "is certainly effectual in preserving a human body from decay for any length of time; but it is extremely tedious, occupying many hours, and is attended with much unnecessary difficulty." He himself embalmed the bodies of three young children by a much more simple method and he records that they were still in the most perfect state of preservation more than twelve years afterwards.

Many of those who experimented in this field guarded their methods so jealously that no record was left of the procedure. This applied to the technique of Dr. Marini who, at the Vienna Exhibition in 1873 exhibited "an assortment of human feet, hands, legs, arms and busts." It was he who embalmed the body of Joseph Mazzini, who died in Pisa on March 10, 1872, and "executed his work so well that the admirers of the arch conspirator proposed to set up the corpse on the Capitol and save economical Italy the expense of a statue. The doctor's preparations, by a process known to him alone, are weather proof and will not only stand wear but take on a high degree of polish."

Two years earlier, Dr. Vivodtsef of St. Petersburg had perfected a method of preservation by the injection into the arteries of a mixture of carbolic acid and alcohol. By this means he had preserved the body of a child of about eighteen months, which he

then "kept under the sofa of his study, a warmly heated room, for eight months." At the end of this period, "the baby looked as fresh as though it were just dead." This seems to have been one of the earliest examples of successful preservation by injection only.

Alas for Sheldon's optimism that, by this method, his carefully prepared mummy would remain unchanged for centuries! A writer in the British Medical Journal of 1899 states that when he saw Sheldon's mummy it had no longer "any semblance of life but was shrunken and hard as a board, the skin of the arms, neck and chest quite white but the face, where apparently the colour injected had remained, a dull red, all the more ghastly for its colour, and the long brown hair is beautiful no more." And in 1857, Cobbe saw the embalmed body of Mrs. Van Butchell in the Museum of the Royal College of Surgeons and makes the following comment in his pamphlet published that year:

> No doubt extraordinary pains were taken to preserve both form and feature; and yet, what a wretched mockery of a once lovely woman it now appears, with its shrunken and rotten-looking bust, its hideous, mahogany-coloured face, and its *remarkably fine set of teeth*. Between the feet are the remains of a green parrot—whether immolated or not at the death of its mistress is uncertain—but as it still retains its plumage, it is a far less repulsive-looking object than the larger biped. By the side of Mrs. Van Butchell is the body of another woman, embalmed by a different process about the same period: she is even more ugly than her neighbour.

Cobbe remarks further: "As curiosities, these few loathsome relics are no doubt both valuable and interesting, but were there a heap of such dry rubbish, one would feel strongly disposed to make a bonfire of the whole, for it looks fit for nothing else."

It is somewhat ironical that the 'bonfire' recommended by Cobbe should actually have materialized in 1941, when not only these two pathetic relics but more than half the contents of the Hunterian Museum were destroyed by enemy action.

BIBLIOGRAPHY

ADAMI, J. GEORGE. *Charles White of Manchester (1728-1813)*. Liverpool, 1922.

BAILLIE, MATTHEW. On the embalming of dead bodies. *Trans. Soc. Improvement Med. and Chir. Know.*, 1812, *3*, 7-23.

BRITISH-MEDICAL JOURNAL. Nova et vetera. John Sheldon, anatomist and surgeon (1752-1808). *Brit. med. J.*, 1899, *1*, 1342.

BROCKBANK, EDWARD MANSFIELD. *Sketches of the lives and work of the honorary medical staff of the Manchester Infirmary from its foundation in 1752 to 1830 when it became the Royal Infirmary*. Manchester, 1904.

CARRICK, GEORGE L. On Dr. Vivodtsef's method of embalming the dead. *Edin. med. J.*, 1870-71, *16*, 503-511.

COBBE, C. *Burning the dead; or urn sepulture.* Pamphlet. London, 1857. 54 pp.

COLE, F. J. *The history of anatomical injections.* Studies in the history and method of science. Charles Singer, Ed. Oxford, 1921. Vol. II, pp. 285-343.

CULLINGWORTH, CHARLES J. *Charles White, F.R.S. A great provincial surgeon and obstetrician of the eighteenth century.* London, 1904.

DORATT, JOHN. On embalming. *Med. Times and Gaz.*, 1871, *2*, 717-718.

FAUJAS SAINT-FOND, B. *Travels in England, Scotland and the Hebrides, undertaken for the purpose of examining the state of the arts, the sciences, natural history and manners.* Eng. Trans. London, 1799.

FOOT, JESSE. *The life of John Hunter.* London, 1794. p. 38.

LANCET. Editorial. A human table. *Lancet*, 1873, *2*, 279.

LEECH, E. BOSDIN. *Picturesque episodes of Manchester medical history.* Presidential Address delivered at the Centenary of the Manchester Medical Society. 3 October 1934. Manchester, n.d., pp. 38-40.

PETTIGREW, THOMAS JOSEPH. *A history of Egyptian mummies.* London, 1834.

RICHARDSON, BENJAMIN W. On the science and art of embalming. Lecture II. *Med. Times and Gaz.*, 1775, *1*, 1.

Two Early American Eulogies on Lavoisier

DENIS I. DUVEEN* AND HERBERT S. KLICKSTEIN**

THE death of Antoine Laurent Lavoisier by the guillotine on 8 May 1794 brought repercussions from all quarters and was to earn France the world's animosity for all time. As Lagrange remarked: *Il ne leur a fallu qu'un moment pour faire tomber cette tête, et cent années peut-être ne suffiront pas pour en reproduire une semblable.*[1] Of particular interest here are two early American eulogies on Lavoisier written by Thomas P. Smith (1777-1802) and John Vaughan (1775-1807).

Little is known about Smith except that he was a very competent chemist and was regarded as such by his Philadelphia colleagues. On April 11, 1798 he delivered the annual oration before the Chemical Society of Philadelphia[2] on the "Revolutions in Chemistry." The oration was published by the Society as a small pamphlet, *A sketch of the revolutions in chemistry* (Philadelphia, 1798, printed by Samuel H. Smith, No. 118 Chestnut Street, 40 pp.)[3] In the course of the speech in which *anti-phlogistic* chemistry was reviewed at some length (pp. 27-33)[4] Smith eulogizes Lavoisier; the latter is on pages 29-31 of the printed oration and follows:

. . . In short, Lavoisier was one of those truly exalted characters that prove the folly of the observation, made by *malicious ignorance*, that a love of science and a performance of the duties of life are incompatible.

Our picture has as yet displayed none but the most pleasant colouring. —Would to heaven I could, consistently with my duty, put it out of my hands, unfinished as it is. But there is one dark shade, which, to complete it, must be laid in, and which will efface the pleasure arising from a contemplation of its beauties.

Lavoisier was strongly attached to the cause of SCIENCE AND TRUTH, and consequently of that of Liberty. When the French Revolution burst forth on the astonished world, he, therefore, early appeared as its

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1 Delambre, "Eloge de Lagrange," *Mémoires de l'Institut*, 1812, p. xiv.

2 W. Miles, *Chymia*, 1950, *3*, 100.

3 The *A sketch* . . . is reprinted in E. F. Smith, *Chemistry in America, chapters from the history of the science in the United States*, New York, 1914, pp. 13-41.

4 Smith presented a remarkably clear exposition of Lavoisier's doctrines, particularly the new chemical nomenclature (pp. 28, 36-39); see D. I. Duveen and H. S. Klickstein, "The introduction of Lavoisier's chemical nomenclature into America" [in press]. The remarks made by Smith on Joseph Priestley are noteworthy (p. 33): "Still however the tottering dome of this once mighty fabric [*phlogiston*] is supported by one solitary pillar, so well constructed, as by its single force to uphold it against the warring elements, nor can it ever fall till this pillar is removed. Never can the doctrine of phlogiston be said to be totally destroyed, until it shall cease to rank among its supporters the name of PRIESTLEY."

advocate. Until at length Robespierre, having *descended* from the elevated station of a Representative of the People, to the debased one of their Tyrant, perceiving that a live of science and truth naturally produced a love of liberty, determined on the destruction of all those who united these dangerous qualities. Lavoisier was one among the many marked out for destruction. No other excuse could be found for his execution, than that he had been a *farmer-general* under the old government. But this excuse, weak as it was, was sufficient for the *tyrant*, who had the *power* and the *will* to destroy him. Let us draw a veil over the fatal catastrophe that has deprived the republic of science of its brightest ornament.* And while we mourne the loss of this benefactor of mankind, let us not lose sight of the pleasing hope that he and his *murderer* shall be remembered as they deserve. Yes! let us cherish the pleasing idea, that while the name of Robespierre shall be remembered with deserved detestation along with those of Nero and Caligula to excite indignation against tyranny and its supporters, that of Lavoisier shall excite in the breast of every votary of science the warmest gratitude!

* When the order for his execution was presented to Lavoisier he requested a few days to complete a course of experiments he had commenced, but this was refused, and he was hurried off to the *scaffold*. What may we not have lost!

The second eulogy was by John Vaughan,[5] a physician of some skill and many interests. Vaughan in his laudation makes a strong protest against the execution of Lavoisier. The remarks, as those of Smith, are reminiscent of the bitter tone of the Robert Kerr outburst in the 1796 edition of his English translation of Lavoisier's *Traité élémentaire de chimie;*[6] this was reprinted in the first American edition in 1799.[7] The eulogy of Vaughan is contained in a small work of 36 pages entitled *The valedictory lecture delivered before the Philosophical Society of Delaware . . .* (Wilmington, printed at the Franklin Press, by James Wilson, 1800); the passages concerning Lavoisier are written as an aside in the section "Of Water" (pp. 24-25). Vaughan was already familiar with Lavoisier's

[5] John Vaughan was born in Chester County, Pennsylvania, studied medicine in Philadelphia under Dr. William Currie, and at the University of Pennsylvania in 1793-1794. He attained some note in the medical profession and was an intimate correspondent of Thomas Jefferson, Aaron Burr, John Dickerson, Caesar A. Rodney, and Benjamin Rush. Vaughan was a member of many scientific groups and in 1799-1800 delivered a course of lectures on chemistry and natural philosophy at Wilmington in the course of which he gave his eulogy on Lavoisier. The valedictory lecture of his series which contains the eulogy was printed in 1800. Vaughan's interest in chemistry may well have been the result of his friendship with Rush who was one of the most outstanding early teachers of chemistry in America. See H. S. Klickstein, *Bull. Hist. Med.*, 1953, *27*, 43-68; W. Miles, *Chymia*, 1953, *3*, 37-77.

[6] *Elements of chemistry, in a new systematic order, containing all the modern discoveries . . . Third edition . . .*, Edinburgh, 1796. Although termed the "Third edition," this 1796 printing actually is a new issue of the 1793 second edition with an added postscript in the prefatory matter; Kerr's remarks on the death of Lavoisier are in the postscript. For full bibliographical details see D. I. Duveen and H. S. Klickstein, *A bibliography of the works of Antoine Laurent Lavoisier, 1743-1794* [in press].

[7] *Elements of chemistry, in a new systematic order, containing all the modern discoveries . . . Fourth edition . . .*, Philadelphia, 1799. This first American edition is a complete reprint of the Kerr "Fourth edition" (1799) which contains the same prefatory remarks as the "Third edition" (1796). See D. I. Duveen and H. S. Klickstein, *op. cit.*, for bibliographical details.

work, having written a *Chemical Syllabus* (dedication signed, Wilmington, November 20, 1799) which was a free presentation of Lavoisier's nomenclature and was intended for the use of laymen not acquainted with the scientific literature.[8] The *Chemical Syllabus* appeared the year before the *Valedictory lecture.* It is also noteworthy that the eulogy contains references to the "water controversy"[9] and the betrayal of Lavoisier by Fourcroy and Chaptal.[10] The eulogy is reprinted below.

OF WATER.

The nature of *water,* was pretty generally enquired into; the doctrines of Priestly [*sic*] and Lavoisier impartially contested; but the laurels of victory were placed on the brow of the Frenchman.* Will not justice pardon a momentary digression, to pay a passing tribute to the memory of *Lavoisier?* May we not obey the dictates of science and humanity, in deploring the premature death of this truly great man? The loss of Chemistry is incalculable, and may long be unrepaired. It is true, we have many worthies left; but, alas! they are not Lavoisiers! His talents were of a superior order —he might well be termed, *a rara avis in terris;* for 'tis seldom nature is so liberal to mortals! Fortune was also bountiful; and he was enabled to indulge his fancy without restraint. But, perhaps, it was fickle fortune, and insatiate ambition, that caused his ruin! The tyrant Robespierre denounced him as a victim of his rage, under some flimsy pretext; the reality, doubtless, was his gold!

It is also said, that his colleagues, Chaptal and Fourcroy might have saved his life, but they envied his talents. Justly, then, may the biographer exclaim—O! cruel, insatiate tyranny! and more inglorious rivalship! Could not the merits of Lavoisier restrain your impious hands? It were better that fifty plebeian chemists had been the objects of your fury, than one Lavoisier! Long will science lament his untimely death!

We do not arraign heaven's high decree, nor plead injustice at the bar of fate! but we contemn those personal causes, which bereaved the chemical world of its brightest luminary!

This lamented genius divested chemistry of many of its absurdities, and strewed the paths of science with fragrant boughs and definite landmarks. Literal construction and common acceptation, are now allied; and chemical phraseology rendered definite and scientific. The terms oxydation, acidification, &c. are legible characters, which every student may read and understand.

But, we must return from the grave of chemistry's beloved son, to those aerial regions, where he was wont to stray. Nay, not stray; but fly, on analytic wings; and mark the *strata* as he pass'd along!

* An hundred parts of water is constituted by 85 parts oxygen, and 15 parts hydrogene.

[8] Vaughan's *Chemical Syllabus* is fully discussed in D. I. Duveen and H. S. Klickstein, "The introduction of Lavoisier's chemical nomenclature into America" [in press].

[9] The "water controversy" is still an argumentive point. For recent summaries consult S. M. Edelstein, *Chymia,* 1948, *1,* 123-137; M. Daumas, *Revue d'Histoire des Sciences,* 1950, *3,* 133-155.

[10] For full account see: E. Grimaux, *Lavoisier 1743-1794,* Paris, 1888, pp. 309-313; D. McKie, *Antoine Lavoisier, scientist, economist, social reformer,* New York, 1952, pp. 408-428; M. Nierenstein, *J. Soc. chem. Ind., Lond.,* 1932, *51,* 438-439.

Notes and Queries

Edited by Ralph H. Major, M.D.* and Dorothy M. Schullian, Ph.D.**

Lionel Chalmers and William Cullen's Treatment of Fevers

The eighteenth century produced a number of theories concerning fever. Friedrich Hoffmann (1660-1742) maintained that fever originated in the spinal cord following contraction of the peripheral arteries and veins and that this contraction was induced by the passage of an etherlike substance along the nerves. John Brown (1735-1788) thought that living tissue was "excitable" and was actually kept alive only by the presence of external stimuli. William Cullen (1712-1790), in his popular and effective teaching at Edinburgh, advocated and expanded Hoffmann's ideas and thought that energy from the nervous system controlled the tonus of the solid parts.

Lionel Chalmers, a Scotsman, later of Charleston in South Carolina, was presumably a product of Edinburgh, although his name is not recorded as a graduate at the University. Born in 1715, he emigrated to Carolina about 1735, and began a practice which culminated in 1776 in the publication of his *Account of the Weather and Diseases of South Carolina.* Perhaps he knew Cullen in early life at the University (the dates suggest it). In later years Cullen referred with some respect to Chalmers' knowledge and experience. This we learn from certain notes recorded by Tucker Harris.

Tucker Harris, M.D. (1747-1821) was born in Charleston, South Carolina, and studied medicine under Lionel Chalmers. He was graduated from Edinburgh in 1771 and presented a thesis *De Cholera Spontanea,* dedicated to Chalmers. He was at various times the physician for St. Philip's parish, a partner with Dr. David Oliphant, a founder and later president of the Medical Society of South Carolina, a senior warden of the South Carolina Society, president of the Fellowship Society, and surgeon to the Light Infantry.

Harris' 529 pages of manuscript notes on Cullen's lectures are preserved in the library of the Medical Society of South Carolina. They are organized and bound and include a title-page, index, and Cullen's tabulated classification of diseases. Cullen's references to Chalmers occur a number of times.

Chalmers is quoted on page 266 (Cure of Fever) as follows:

Where the Disease is truly intermittent, but has combined with it Diathesis Phlogistica, here sweating is admiscible and accordingly we find that Dr. Chalmers of South Carolina had great success in such fevers by sweating: for I am persuaded that the fevers that he took for Inflamatory, were truly Intermittent at bottom. Look into page 51 of the London Edit. of his work, you will find he says that 'nothing is more common in this country

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than for Pleurisis and Peripneumonies in a strong man to become Intermittent in 24 hours after their attack.' What I have above advanced appears to be confirmed from the success of Purging (?) in such fevers; & w^{h} the Ingenious Doctor used with very great success in a long Practice.

Dr. Chalmers gives us some useful advice, he does not keep up the sweat for a very long while but advises his patient to keep his Bed for 48 hours,—

4th. In Sweating we should certainly make it extend to (?) Extremities. This Dr. Chalmers attended to, & perhaps to this it was (?) he owes his more successful practice, than others in that Country— (page 267)

(Cure of Rheumatism)

But I agree w^{e} Dr. Chalmers that the patient sh^{o} Continue in Bed for 48 hours after, to defend the Patient from any Cold he might take from exposure to the Air. (Page 452)

(Cure of Arthritis)

I observed *Dr. Chalmers* of *So. Carolina* used to keep his Patients in Bed 48 hours after sweating. (Page 514)

One might gather that Cullen had at least a considerable respect for Chalmers' experience and judgment.

In the library of the Medical Society of South Carolina there is also a copy of Cullen's *First Lines of the Practice of Physic* (Edinburgh, 1786) containing many notations in longhand. They were apparently taken from lectures. The name Joseph N. Wilson[1] is written on the title page. The notes here are not in the same tone of agreement as those above. On page 214 we read, "Chalmers says indeed that he has cured inflamatory Fevers even Pleurisy and Peripneumony by sweating only, but Dr. C. doubts much the truth of this observation." On page 217, "Dr. C. took this from Dr. Chalmers as he practised in this way & made use of Kermes Mineral." Again later in reference to Kermes Mineral (antimony), there appears a note, "The person I allude to is Dr. Chalmers of Carolina. He depended much on the Kermes mineral—"

Chalmers' *An Essay on Fevers* was published in Charleston in 1767,[2] and another edition appeared in London in 1768. Chalmers wrote that much of his basic knowledge had come from Dr. John Lining, Charleston's eminent physiologist, and went on to say: "The authour hath supposed, that a spasmodic contraction of the arteries and other muscular membranes, is the immediate cause of feverish disorders, in whatever way this may be brought on; . . . for all the symptoms in acute diseases show something of this sort, the severity or mildness of those distempers, for the most part keeping pace with the degree of that constriction, and the number of vessels it affects." His desire was to remove the fever in its early stage, to "cure" the disease within its first day or two. He refers to Hoffmann and to Boerhaave as the sources of his ideas concerning fever.

[1] Joseph N. Wilson of Charles-Town graduated at Edinburgh in 1788. His thesis *De Tetano* was dedicated to Dr. Peter Fayssoux of Charleston.

[2] *An Essay on Fevers* was printed in "Charlestown" by Robert Wells, father of William Charles Wells, and "sold at his Shop on the Bay."

His suggestions for treatment were based on an effort to relax the constriction of the peripheral vessels. Therefore, his methods consisted of purging, of applying hot bricks to the legs to produce sweating, and of keeping the patient in bed and warm, even to the requirement of a warmed bedpan. Bleeding was not in his regimen, and he took time to remark that it was a practice greatly overdone in South Carolina. His only drug other than the purgatives was the Kermes mineral.

Cullen's treatment of fevers was not in accord with that of Chalmers. External heat was to be avoided and cold was to be used; mild acids, nitre, sedatives, and above all, bloodletting, were favored; and purging was urged. Yet Cullen seems to have indicated a considerable regard for Chalmers' ideas. Possibly it might be suspected that Cullen was making some kindly concession of interest in Chalmers' ideas for the benefit of a young colonial student who wished to see justice done to his preceptor, but his remarks ring sincerely enough. Whatever may have been the link between Cullen and Chalmers, it is interesting to note the unusual influence of a provincial Carolinian practitioner on the great medical teacher and leader in the capital of the medical world of the eighteenth century.

JOSEPH I. WARING

Bound in Full Human Skin

In 1932 the Lane Medical Library purchased from Maggs Bros. of London a volume containing six anatomical tracts by B. S. Albinus (1736-41), each with its magnificent color-plate illustration by Jan Ladmiral. While this was sufficient to make the acquisition a notable one, the volume also has the bizarre distinction of having been bound in human skin. Such bindings are far from uncommon, but in the case of this volume there exists a rather unusual sort of knowledge, the statement of the binder, Paul Kersten of Schöneberg, Germany. In 1910 the untanned skin was given to Kersten by someone to whom he refers merely as "the possessor," but presumably the Hans Friedenthal whose name is to be found on the silver repousse set into the front cover. The binder then took the skin, measuring 65 x 75 cm., to a tannery where in the course of tanning it was shrunk 1 cm. To continue in his own words:

> The grain was noteworthy since to some extent it resembled a mixture of large-grained goatskin and pigskin; the portion representing the back had the coarser grain while the breast and belly areas were smaller grained. In thickness it corresponded to morocco leather, at the back 2 mm., at the side 1 mm. It had a very considerable toughness and was somewhat difficult to work to a smooth surface since the grain extended rather deeply into the skin, much as in pigskin; otherwise it felt like morocco leather, and were it not white it would be taken for such. . . .
>
> The front cover inset a magnificent plaque modelled and engraved in silver by the Weimar sculptor Prof. Elster, displaying the head of a negro and an example of a negroid skull. Above is the name of the illustrator and

below the name of the owner, the whole represented as an *ex libris*. The end-papers of the inner sides of the covers are made of moleskin and the fly-leaf of mole-grey silk. (*Zeitschrift f. Bücherfreunde*, 1911, p. 264.)

The binder does not state why the owner chose such an odd binding nor that the original white skin was dyed black. The reason for this latter fact, as well as the subject of the repousse was apparently derived from the second of the tracts the title of which may be translated as "On the location and cause of the color of Ethiopians and of other peoples." The Ladmiral color-plates, it may be said, are excessively rare and deserve a sumptuous binding. The owner apparently agreed but presumably saw an opportunity, if not a very strong justification, for fulfilling a bizarre desire as well.

CHARLES D. O'MALLEY

A Vesalian Letter

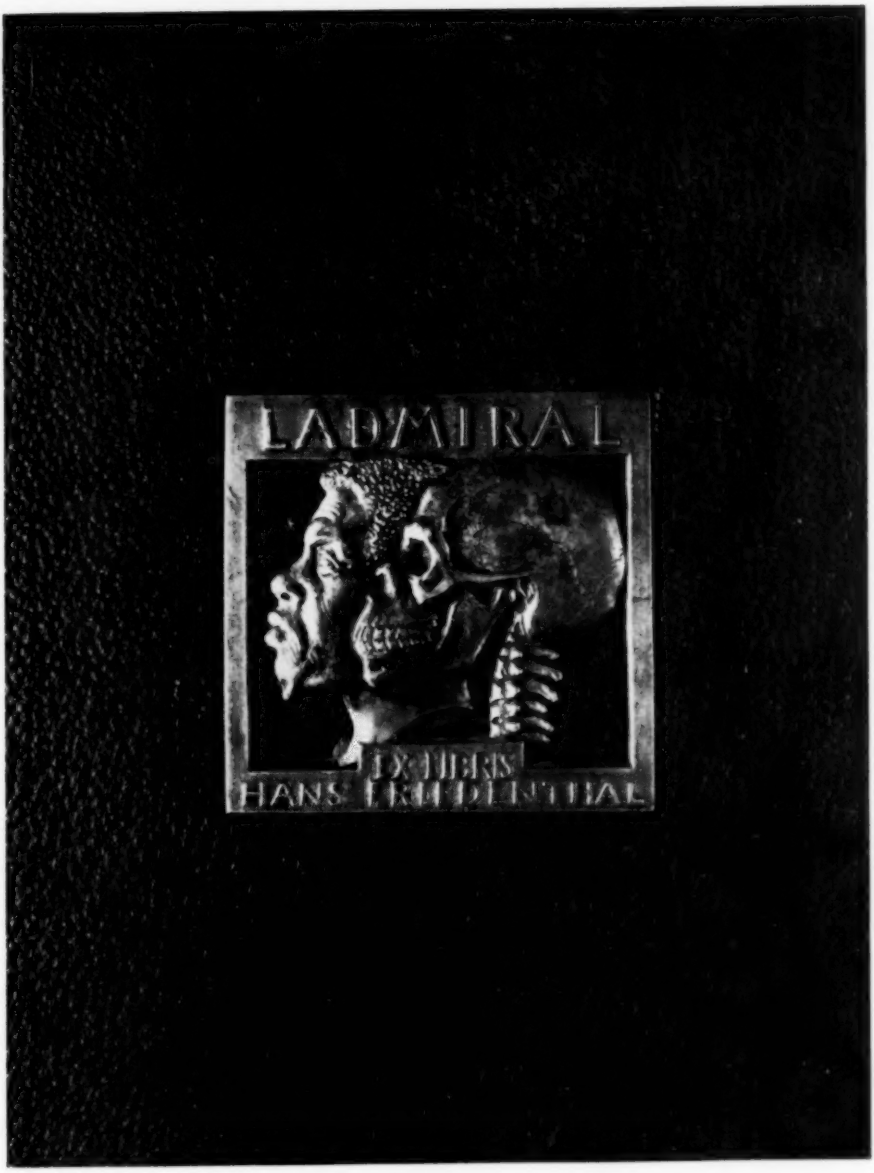
Letters written by the sixteenth century anatomist, Andreas Vesalius, are few in number, and it is therefore gratifying to record that one has been added to the Cushing collection, having been presented to Yale University a few months ago. An inaccurate transcription of the letter appeared in *Unpublished letters from the collection of John Wild. Selected and edited by R. N. Carew Hunt* (New York, The Dial Press, 1930, pp. 175-6); but since it may not be widely known to the medical profession it is being recorded again as corrected by Prof. C. D. O'Malley. To the best of our knowledge it is the only known example of a letter by Vesalius in French. It is undated, but Prof. O'Malley points out that it must have been written early in 1558 at a time when both the prince of Orange and his wife were ill; she died at Breda on 24 March of that year. The text follows:

Monsieur, samedi passe est party dicy un des serviteurs de vostre Excellence avecques une mienne lettre escripte à maistre Art touchant du discours de la maladie de Madamme et contenant a parte une aultre avecques luy escripte a vostre Excellence par commandement de Madame pour soliciter vostre venue, et pourtant Monsieur que ie pense que Monsieur ayt receu les dits Lettres ny men estendra plus loing principalement que [or quel?] les affaires depuis le partement du dit serviteur sont peu changees. toutesfois les cures de la nature sont estees telles que ie pense que Monsieur arrive en temps de consoler et recreer Madame de sa presence, laquelle est sans la fievre continue fort attainte d'une grande et merveileuse melancholie, comme Monsieur entendera plus amplement quand il sera icy. laquelle chose iespere estre tantot et de brief. entretant ie me recommande treshumblement a sa bonne grace. de Breda le XV de Mars.

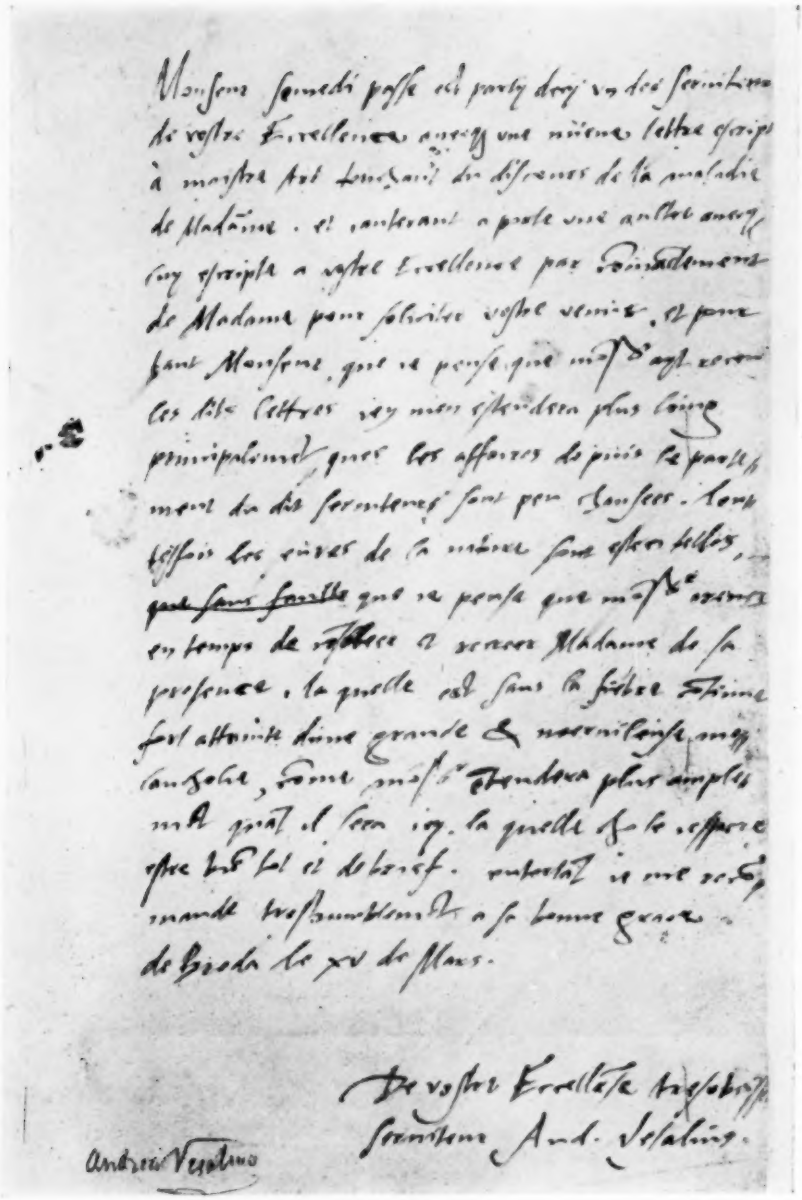
De Vostre Excellence
tres obeiss^{t} serviteur
And. Vesalius

A mon Seigneur et frere le Prince d'Orange Comte de Nassau.

M. E. S.



Volume Bound in Human Skin



Letter from Andreas Vesalius to Prince d'Orange Comte de Nassau

Samuel Clark Harvey (1886-1953)

The *Journal* records with regret the sudden death on 22 August of one of its closest friends, Dr. Samuel Clark Harvey, Emeritus Professor of Surgery and later of Oncology at the Yale University School of Medicine. After his retirement, Dr. Harvey had joined the new Department of the History of Medicine at Yale and had participated in the teaching of the history of surgery and in many other activities of the Department. At the time of his death, Dr. Harvey was President of the Beaumont Club and Chairman of the Program Committee for the meeting of the American Association of the History of Medicine scheduled to be held in New Haven in May 1954; he was also Editor of *The Yale Journal of Biology and Medicine.* His successors in these various responsibilities have not as yet been determined. A more detailed appreciation will appear in a subsequent issue of the *Journal.*

J. F. F.

T. Archibald Malloch

We regret to announce the death on 19 September 1953 of Dr. T. Archibald Malloch, one of our Consulting Editors, after a long illness. Dr. Malloch came from an old Canadian medical family. During the First World War he served in the Medical Corps of the Canadian Army and became a protégé of Sir William Osler, attending him during his last illness.

In 1925 he was appointed Librarian of the New York Academy of Medicine, and in that capacity was responsible for developing policies and for modernizing procedures in the second most important medical library in the United States. Dr. Malloch made many contributions to the literature of medical history, his most important being the biography entitled, *Finch and Baines,* published by the Cambridge University Press in 1917.

J. F. F.

Eugène Le François

We regret to announce that Monsieur Eugène Le François, the eminent dealer in French medical books, old and new, died on 30 May 1953 at the age of sixty-eight after a brief illness. To the Editor of this journal the death of M. Le François brings a sense of very real personal loss, for during his student days in Paris in the early 1920's, M. Le François made available to him some of the great books in the history of medicine—books which even the limited purse of a student could then afford. Perhaps the most outstanding acquisition came just thirty years ago when he offered a copy of the first edition of Laennec's *Auscultation Médiate,* 1819, inscribed by Laennec to his uncle—"Optimo dilecto patruo secundo patri"—a book that will eventually be returned to France.

M. Le François, ever modest and unassuming, was a gracious friend of physicians and medical collectors throughout the world; some knew him

only through his colorful associate Monsieur "Gustave" [Morice] but all who had dealings with the firm appreciated its friendliness and kindness. The *Bibliographie de la France* for 12 June 1953 records that the funeral, attended by many of his confrères, took place on 3 June at Saint-Sulpice, a church situated a short distance from the premises at 91 Boulevard St. Germain where, as an inheritor of a great family tradition, M. Le François lived and worked from the time, some forty years ago, when he took over the direction of the firm. We are glad to record that Madame Le François has become the *Directrice* and that she will be ably assisted by her two sons-in-law, both of whom are graduates in medicine of the Faculté de Paris.

J. F. F.

The Story of Medicine in Art

The Milwaukee Art Institute has brought together from various art galleries, libraries, and private individuals in this country and abroad a most interesting exhibit to portray the rôle of medicine in art. Under the joint sponsorship of the State Medical Society of Wisconsin, the Medical Society of Milwaukee County, the Boston Store of Milwaukee, and the Milwaukee Art Institute the display runs from 11 September to 25 October, having been opened with a lecture by Dr. Howard Dittrick of Cleveland on "Aztec terra cotta figures depicting disease." Only a few of the main divisions of the exhibit can be mentioned: portraits of doctors, medical diplomas, medical bookplates, medical stamps, medical medals, ancient medicine, depiction of disease, mental disease, vaccination, public hygiene, surgery, hospital care, superstition, caricatures of medical practice, medicines, apothecary shops, anatomical illustration, and medical illustration. An illustrated catalogue of the exhibit has been issued and is available for fifty cents.

Rijksmuseum voor de Geschiedenis der Natuurwetenschappen (National Museum for the History of Science)

Leyden, Netherlands

On the occasion of the centenary of the birth of two famous Dutch physicists, Hendrik Antoon Lorentz (1853-1928) and Heike Kamerlingh Onnes (1853-1926) a commemorative exhibition was held from June 20th to August 30th. Lorentz may be considered as the link between classic and modern physics. His electronic theory laid the foundation for the atomic theory, and the Lorentz contraction for the theory of relativity.

Kamerlingh Onnes was the organizer of the cryogene laboratory at Leyden which now bears his name. He was the first to liquify helium (1908) and he discovered the superconductivity of certain metals. He was called "le gentleman du zéro absolu."

World Congresses and Meetings

During the summer just past there have been a series of Congresses important for those interested in the history of medicine, and Dr. Fulton, the Editor of the *Journal,* has just returned with the following report:

First International Congress on Medical Librarianship. This was held in London during 20-25 July under the Chairmanship of Sir Cecil Wakeley, President of the Royal College of Surgeons. The Congress had been planned by a group of medical librarians in London including William LeFanu, Librarian of the Royal College of Surgeons, who acted as President, William Bishop, F. N. L. Poynter of the Wellcome Medical Library, and Cyril C. Barnard, Librarian of the London School of Hygiene and Tropical Medicine. There was a large attendance with some forty countries represented, and the Congress closed with papers on international co-operation followed by a full discussion of the British-Swedish proposal to establish an international medical library association. An international committee of nine, composed of the following members, was formed to expedite the undertaking:

William LeFanu, *Chairman,* United Kingdom

J. Anker, Denmark	R. Eriksson, Sweden
W. J. Bishop, United Kingdom	A. Hahn, France
S. A. Chitale, India	K. J. Hartmann, Germany
Eileen Cunningham, United States	A. H. M. C. Kessen, Netherlands

Lt. Colonel Frank B. Rogers, Director of the Armed Forces Medical Library, took an active part in the discussions and also in those of the World Conference on Medical Education which took place in London a month later.

First World Conference on Medical Education. By happy coincidence, but scarcely by chance, the First World Conference on Medical Education was also held in London, during the week of 24 August, a month after the First International Congress on Medical Librarianship. It proved to be an even larger gathering with representation from fifty-nine countries. It was held under the chairmanship of Sir Lionel Whitby, Regius Professor of Medicine at Cambridge, who, in his opening Presidential address, made an eloquent plea for reconsideration of the medical curriculum, the mode of selecting medical students in all countries, and in broad terms urged that the Conference reconsider the basic aims and objectives of medical education. Dr. Fulton participated in the opening plenary session by reading a general paper on the history of medical education which was published in the *British Medical Journal* for 29 August 1953. Following the opening session on Monday there were four special sessions each one of which continued for four days and dealt with the following general themes: Requirements for Entry into Medical Schools, Aims and Content of the Medical Curriculum, Techniques and Methods of Medical Education, Preventive

and Social Medicine. Résumés were presented at the plenary sessions on Friday and Saturday.

Vth International Neurological Congress. This was held in Lisbon and Madrid on 7-15 September. From the point of view of a medical historian, the Congress was important because it commemorated the centenaries of both Constantin von Monakow and Santiago Ramón y Cajal. Professor Minkowski of Zürich read a paper on von Monakow in which he emphasized the broad contributions which von Monakow had made to neurology and neuroanatomy. Von Monakow's daughter, Fräulein Masche von Monakow, was present on the podium at the reading of Professor Minkowski's paper. Later in the week Dr. Minkowski also spoke on von Monakow's contributions to knowledge of the parietal lobes.

Cajal Centenary. This was held in Madrid on 14-15 September as a second session of the Congress, opening with a visit to the Cajal Museum at the Institut Cajal and later in the day (the 14th) continuing with a series of papers at a formal session in the Salón de Actos of the Superior Council of Scientific Research. The chair was taken by Professor López Ibor, President of the Spanish Committee, who read an introductory eulogy on Cajal and Spain. Professor Fulton represented the United States and spoke of Cajal and neurophysiology. Professor Sir Russell Brain, who spoke on the future of neurology, represented England; Professor de Wulff, representing Belgium, dealt with Cajal and neuroanatomy, and Professor Trelles, of Perú, gave a general résumé of Cajal's influence on scientific medicine. In conclusion, Professor de Castro offered a moving tribute on behalf of Cajal's disciples. The addresses are to be published.

IId International Congress of Hippocratic Medicine. During 3-6 September the Congress on Hippocratic Medicine forgathered at Evian, France, on invitation of the Société d'Evian-Cachat under the presidency of Professor Laignel-Lavastine* of Paris. Five general themes were considered, all relating to 'Hippocratisme.' Thus there were papers on homeopathy, eclecticism, biotypology, endocrinology, women physicians, hydrotherapy, psychophysiological physicians, etc. Dr. Jules Cottet, one of the local Congress members, discussed "Evian et le Thermo-Climatisme Hippocratique."

Società Italiana di Storia delle Scienze Mediche e Naturali

The Sixth National Congress of the Società Italiana di Storia delle Scienze Mediche e Naturali will be held in Verona 24-25 October 1953. It will be devoted primarily to a celebration of the fourth centenary of the death of Girolamo Fracastoro. There will be an exhibit of manuscripts of Fracastoro and of the principal treasures of the Biblioteca Capitolare of Verona, a visit to the outstanding monuments of Verona, and an excursion to the Villa Fracastoriana of Incaffi and to Sirmio. The President of the

* We regret to record that Professor Laignel-Lavastine died suddenly on 5 September 1953 while en route to the Congress.

Società is Prof. Andrea Corsini; President of the Organizing Committee is Prof. Francesco Pellegrini, whose studies on Fracastoro are so well known to historians of medicine in America.

International Congress of the History of Medicine

A preliminary program for the Fourteenth International Congress of the History of Medicine has been issued from the Istituto di Storia della Medicina, Città Universitaria, Roma. The congress will meet at the Istituto and elsewhere in Rome 13-17 September 1954 and at Salerno 18-20 September 1954. Special topics under consideration will be: (1) The part played by medicine as a means of union among peoples; (2) The contribution of medicine to the progress of civilization; (3) The School of Salerno. It is requested that titles and brief résumés of papers, not exceeding 200 words, reach the Istituto in duplicate by 15 March 1954. The President of the Organizing Committee is Prof. Adalberto Pazzini.

Michael Servetus 1511-1557

The fourth centenary of the death of Michael Servetus has brought forth many studies which will be reviewed in this *Journal* in due course. At present we merely direct attention to four titles all of which are to be published within the calendar year 1953.

Roland H. Bainton. *Hunted heretic. The life and death of Michael Servetus.* Boston, Beacon Press, 1953. xii, 270 pp. French translation, *Michel Servet, hérétique et martyr, 1553-1953.* Geneva, Librairie E. Droz, 1953. 148 pp., 1 *l.*

B. Becker, Editor. *Autour de Michel Servet et de Sebastien Castellion.* Haarlem, H. D. Tjeenk Willink & Zoon N.V., 1953, vii, 302 pp.

Charles Donald O'Malley. *Michael Servetus. A translation of his geographical, medical and astrological writings with introduction and notes.* Philadelphia, American Philosophical Society, 1953. (Memoir 34); also London, Lloyd-Luke (Medical Books) Ltd., 1953, 208 pp.

John F. Fulton and Madeline E. Stanton. *Michael Servetus, humanist and martyr. With a bibliography of his works.* New York, Herbert Reichner (in press).

Professor Bell at William and Mary

Whitfield J. Bell, Jr., Professor of American History in Dickinson College, Carlisle, Pennsylvania, who edits the annual Bibliography of the History of Medicine of the United States and Canada, is serving this year as visiting professor of history at the College of William and Mary and acting editor of the *William and Mary Quarterly,* Williamsburg, Virginia.

Medicinal Leeches Becoming a Matter of History

The column "About New York" by Meyer Berger in the *New York Times* of 27 May 1953 contained information of interest to historians of medicine. The fact that the physicians of the Kremlin had resorted to leeches in an attempt to save Joseph Stalin had prompted Mr. Berger to seek out Mr. Salvatore Anatriello, one of the last two importers of *Hirudo medicinalis* in New York City. Mr. Anatriello told him that when he entered the trade three decades ago, he was one of sixteen importers of medicinal leeches, and fifty drugstores in Manhattan alone carried them. Gray's Drugstore in Times Square stocked them for the 'black-eye' trade and they were used for occupational injuries, particularly by miners. Now only a half-dozen shops sell them, and in the major cities all over the country there has been a corresponding drop.

The leeches are bred in fresh-water lagoons on the coast of Portugal and Mr. Anatriello makes regular trips to Idlewild to meet his shipments which usually contain 2,000 to 3,000 specimens. Three-inch leeches, the best size, sell for seventy-five cents, three times the pre-war price. Mr. Anatriello still places advertisements in medical journals, but the leech, which he looks upon as a friendly creature, is being supplanted by more drastic measures appropriate to this Atomic Age.

E. H. T.

College of Physicians of Philadelphia
Section on Medical History

The Section on Medical History of the College of Physicians of Philadelphia will again offer six weekly lectures on medical history to the students of all the medical schools of the city during the autumn. The lectures will be given from 7 to 8 p.m. at the Hall of the College of Physicians at 19 South 22d Street in Philadelphia. The course is supported by the five medical schools of the city and will be conducted by Professor Richard H. Shryock and Dr. Owsei Temkin of the Institution of the History of Medicine at Johns Hopkins University. The lecture schedule is as follows:

12 October	Introductory: The Meaning and Values of Medical History—Dr. Shryock
19 October	Greek Medicine—Dr. Temkin
26 October	Renaissance Medicine—Dr. Temkin
2 November	Seventeenth and Eighteenth Century Medicine—Dr. Temkin
9 November	Nineteenth and Twentieth Century Medicine—Dr. Shryock
16 November	Social Aspects of Medical History—Dr. Shryock

All who are interested are cordially invited to attend.

Thoughts on the Times

On 15 September 1953 there were to be found among the acquisitions of the day at the Yale Medical Library two books which offered an interesting parallel. One of these was *Sexual Behavior in the Human Female* by Alfred C. Kinsey et al., published by W. B. Saunders, 1953, the other was entitled *Thoughts on the Times, but chiefly on the Profligacy of our Women and It's Causes. Addressed to Every Parent–Husband–and Modest Woman in the Three Kingdoms.* The author's name does not appear; the treatise has been attributed to Philip Thicknesse, but it was more probably written by Francis Foster whose signature appears on the title-page of the copy which has come to the Historical Library–second edition printed in London in 1779.

Thoughts on the Times is in two parts, Part I being concerned with the dangers of incontinence, the absurdity of female education, and the bad effects of fashion and what the author terms "the French refinement." Part II is a protest against the employment of men midwives. On page 11 the author writes: "It is with this View [that every man should do his utmost to stop an evil] I shall endeavour to expose those Causes, which I think lead to the Ruin of female Virtue. I value not the Approbation or Censure of any but the worthy Part of the Community–and I hope the Motive by which I am actuated, will, in *their* Estimation, cover any Defects that they may find in the Performance. I protest that when I consider the present Mode of female Education–the Life our Women lead–the French Refinement that has crept into our Manners–how much Fashion has become a Tyrant–and, above all, that shameful, scandalous Custom of employing Men-Midwives . . . so far from being surprised at the Number of Women, who daily are detected destitute of Virtue–I am surprised to find the Number is not trebled!"

History thus demonstrates that the problems of the eighteenth century were not far different from those of the twentieth; only the methods for investigating them and the theories offered for their solution change!

E. H. T.

Revista de la Sociedad Venezolana de Historia de la Medicina

The *Journal* welcomes the appearance of a new South American publication dedicated to the history of medicine and wishes it all success. Volume I, number 1, bearing the notation of Caracas, January-April 1953, is published under the auspices of the Ministerio de Sanidad y Asistencia Social and, as is natural, portrays particularly the medicine of the country. The editors have paid special tribute to José Maria Vargas and also have reprinted an address given by him over a century ago which contains recollections of medicine and physicians of Caracas. There is a long article by Guillermo Soto on the medical history of hospitals in Caracas from pre-Columbian days to the present, an appreciation of Franz Jahnel, the

psychiatrist, by M. L. Sánchez Martín, and an 'Almanac of Medical History' which contains many useful and interesting anniversary dates falling in the months of September-December. The final section on 'Individuals and institutions interested in the study of the history of medicine' is an ambitious undertaking but fraught with many pitfalls. Professor Tricot-Royer, for example, died in 1951, being now succeeded in the chair at Louvain by Professor F.-A. Sondervorst; Dr. H. P. Bayon also died before the first issue of the *Revista* appeared. It is to be hoped that if this section is to appear from time to time, it can be revised and expanded; reference to the various published lists of members in national organizations of the history of medicine would be of assistance.

The Tomb of Thomas Hodgkin in Jerusalem

Dr. S. J. Plaschkes of Tel-Aviv has sent to the *Journal* a photograph of the tomb of Thomas Hodgkin which was earlier referred to in Notes and Queries (1951, Vol. VI, p. 411). Since we find no record of the Hodgkin monument, we reproduce the two excellent photographs herewith. Hodgkin, an inveterate traveller, died at Jaffa on 4 April 1866.

Servetus, Valverde, and the Lesser Circulation

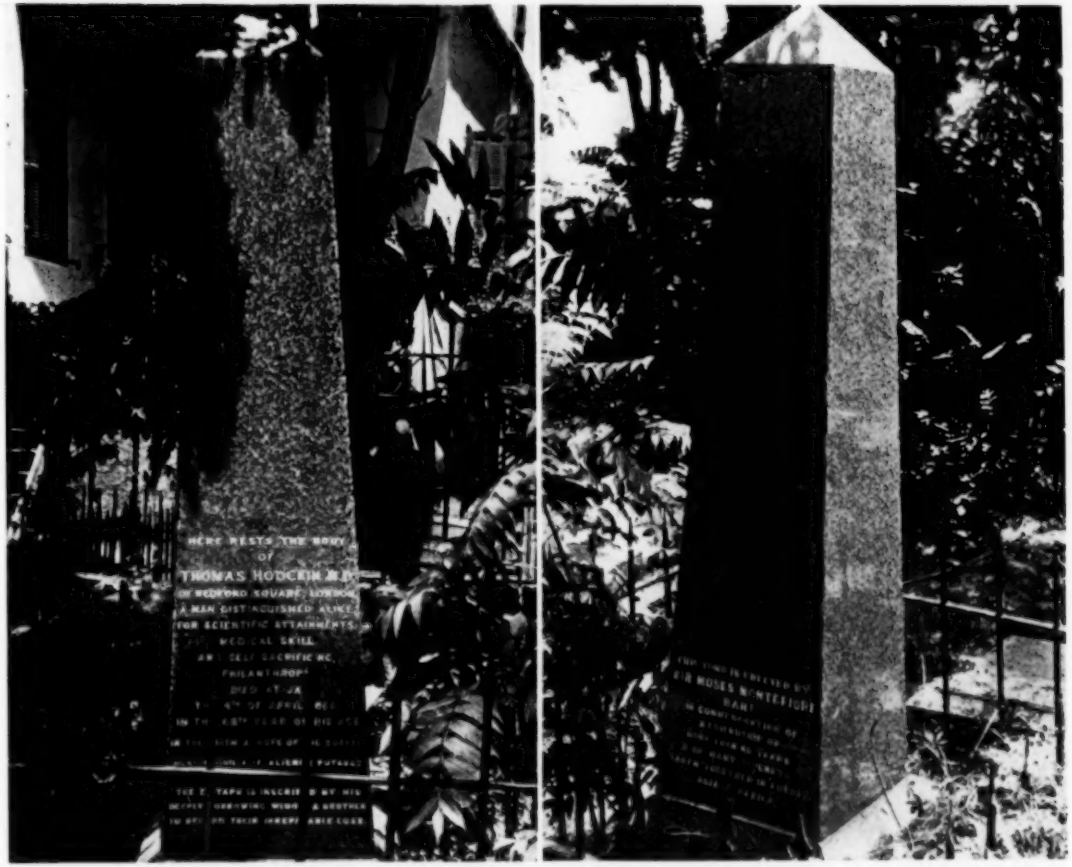
In this, the four hundredth anniversary year of the death of Michael Servetus, who first described the circulation of blood from the right to the left side of the heart through the lungs, it is fitting that we should take note not only of John Calvin's barbaric act in burning the founder of the Unitarian movement, but of the circumstances of his discovery of the lesser circulation. We have little knowledge of how Servetus came to make this discovery, but the description which appeared on pages 170-171 of his book *Christianismi restitutio* is both lucid and complete and is the first printed account of this advance in physiological knowledge.

Three years after the appearance of the *Christianismi restitutio,* Juan Valverde, also a Catalan, published his *Historia de la composicion del cuerpo humano* (Rome, 1556), in which he likewise described the pulmonary transit, as observed by him and Realdo Colombo.* A Spanish major in Yale College, Mr. Fred Dickson, while a student in Science IX, made the following translation of Valverde's passage on the lesser circulation as part of a term paper. We feel it appropriate to publish this translation, the original of which appears on folio 97 [sig. X iv] of Valverde's *Historia.*

ON THE ARTERIAL VEIN AND THE VENOUS ARTERY

We must speak, in order to complete this book [Book 6], about the 3rd vein and the 2nd artery. The vein is born in the uppermost part of the right ventricle of the heart and descends along the right side of the trachea;

* The Valverde description has been discussed at some length by Dr. Josep Trueta in a paper entitled "Michael Servetus and the discovery of the lesser circulation" (*Yale J. Biol. Med.,* 1948, *21,* 1-15).



Two Views of the Tomb of Thomas Hodgkin in Jaffa (Israel).

then dividing into two branches, one of which goes to the lung of the left hand side, and the other to the lung of the right hand side, and each one of these divides itself in a similar manner, into two branches, and those two into four, and thus on down the line, always becoming smaller, until in this manner each of the two primary branches fills up the particular lung to which it belongs. The tunic of this vein is very similar to that of the arteries and for this reason it is called the arterial vein. The artery is born on the left side of the widest part of the 2nd ventricle of the heart, and is distributed also in the lungs, first dividing into two parts, and afterwards into approximately the same number of branches as the arterial vein. The tunic of this artery is quite thin and very similar to that of the veins and for this reason this vessel was named the venous artery; it bears the name artery because it contains blood and air or spirit as do the other arteries. The function of the arterial vein and of the venous artery (according to all who have written before me) is that the veins feed the lungs only, and that the artery carries the air of the lungs to the left ventricle of the heart, that in this artery it was not possible, in any way to see blood, but if they would have experimented to this effect (which I many times together with Realdo, have done with animals both dead and alive) they would have found that this artery is just as full, comparatively, of blood as any other artery. Nor can we say that the blood enters this artery after death has taken place, because if you open some living animal, you find the blood overflowing from the cutting, the heart locks in the blood it has without letting it escape and if any blood flows it is most reasonable to conclude that it flows from the mouth of the great artery where it would ordinarily leave, rather than any other place. Even better if you can open the heart and drain off all the blood in it and after this look into the venous artery, which they would find without doubt full of blood. Thus we conclude that there is blood in this artery, and that it cannot enter from the left ventricle into the artery (which demonstrates the place of the valve films, which we said to be at the mouth of this artery). I feel sure that the blood oozes from the arterial vein, combines itself with the substance tissue of the lungs where it is made thin and prepared to be converted more easily into "espiritus," and afterwards it is mixed with air, entering through the branches of the tracheae, goes jointly with the blood to the venous artery and from there to the left ventricle of the heart, mixing with the thicker blood, which from the right ventricle passes to the left (if any did pass) because until today I have not seen where it could pass; however, if it does pass, from both bloods is made a material which is ready to be converted into spirits, which give us life. This is my opinion besides the fact that reason confirms it, because presupposing that in the venous artery one finds blood (which anyone who does not wish to believe me can see for himself) it is necessary to say that from the venous artery the blood goes to the left ventricle; it is also more likely than thinking that the blood in the right

ventricle (which is little different from that of the great vein) without undergoing any other transformation could have created in it "espiritus" which gives life. But leaving this aside because it is a point outside of my purpose, it is sufficient to know that in the venous artery without any doubt whatever there is blood and not air alone—as all of those who have written before me have said. And what it all comes to—each one to his pleasure can consider, and with this I shall finish the history of the veins and arteries and start on that of the nerves.

Book Reviews

MAIMONIDES. *Ueber die Lebensdauer. Ein unediertes Responsum, herausgegeben, uebersetzt und erklaert von Gotthold Weil, Jerusalem.* Basel-New York, S. Karger, 1953, 55 pp. Swiss frs. 8.30.

Reviewed by MORDECAI B. ETZIONY, *a general practitioner of Montreal, Canada.*

THE problem of longevity is not new. Not only has the Lawgiver pointed to the way of prolonging man's days, making it his fifth commandment, but many a sage and philosopher since has attempted to define good living, leading in turn to a longer lease on life. And, last but not least, Medicine too, is determined, perhaps now more than ever before, to turn the incredible saga of Methuselah's old age into reality. With great advances made in the physical and biological sciences medicine of today is hopeful of giving humanity a 'new deal' on life, both in kind as well as span.

It is therefore with particular interest that one reads Gotthold Weil's edition of the hitherto unpublished Responsum 'On Longevity,' ascribed to Maimonides and quoted by an anonymous writer of a commentary on the Mishney Tora of the great mediaeval philosopher and physician. The word 'ascribed' is used advisedly, because in the introduction Weil himself is guarded in his statements about the authenticity of the responsum or its metamorphosis. In fact, he apologetically hopes that he will prove to be right in regard to the textual as well as the interpretive aspects of the publication. For among the Hebrew and Arabic manuscripts of the 'Shapira' collection which was scrutinized by Steinschneider, there were various Arabic commentaries on Maimonides' Mishney Tora; Steinschneider dwells particularly upon 'No. 102' because in it an anonymous commentator brings forth a hitherto unknown responsum of Maimonides to one of his pupils, Joseph ben Yehuda, in the form of an extract in connection with an explanation of the section Hilkhot Deot of the Mishney Tora.

Be that as it may, the four-page Arabic text in Hebrew transliteration (given to us also in a six-page German translation by Weil), has apparently been zealously followed up via Moritz Steinschneider (re. MSS Shapira), David Kaufmann, Neubauer and A. Cowley of the Bodleian Library, going as far back as 1879. Furthermore, in the fifth chapter of his discourse, under the title 'Disposition and sequence of the Responsum,' Weil discusses painstakingly the difficulties one would run into if he were to accept in good faith not only the authenticity of the manuscript but also the knowledge and exactitude of the anonymous copyist.

We cannot afford to go into all of Weil's arguments, nor will we dwell upon his interesting comparative consideration of the problem of the Islamic 'Adjal,' either as envisaged in the Koran by the conservative Asharists, or the 'heretic' Mutazalists in their Kalam; nor will we follow the

author in his discussion of the problem of longevity as found in the predecessors of Maimonides, the Gaonim Saadya and Hai, whose theologic-philosophical thesis does not strictly touch our present field of interest.

Now let us turn to the Responsum proper. Joseph ben Yehuda, the pupil, poses his master Maimonides the following query: Is the duration of man's life on this earth delimited and fixed and its end predetermined, or are there available measures and means to be chosen whereby his life may be prolonged? As a general basic statement, the answer given is this: "With us Jews there is no predetermined final term of life. The state of life is continued as long as there is replacement of that which is destroyed from its substantial moisture, and its state thus remains undebased, as Galen said: 'The cause of death is the destruction of the equilibrium of the innate heat.' And this corruption is permitted to arise in the wake of causes which affect it from without."

Maimonides then devotes his discourse first to the bio-physiological considerations and secondly to the theologic-teleological, to him apparently the more important aspects of the discussion. The latter are very interesting and stimulating, but based as they are on an *a priori* credence in Deity, they do not lend themselves to any factual and therefore scientific quest. We shall nonetheless, for completeness' sake, take up the second part first, albeit more briefly.

There are two kinds of proof to validate our argument: Those of religious law, and those of the 'natural applied sciences,' namely, mathematics, physics, and metaphysics. And it is the religious laws that lead us on to salvation in the world to come. These latter laws of God (the Tora), are the very pillars on which Maimonides leans and brings to bear as proofs that life can be prolonged. He accomplishes his task clearly and adroitly, and to the faithful undoubtedly with conviction. To illustrate with two such proofs Maimonides puts forth: "It is commanded (Deut.22,8): 'When thou buildest a new house then thou shalt make a parapet for thy roof, that thou bring not blood upon thy house, if any man falls from thence.' This verse proves that the provision and availability of preventive measures can and do prevent the occurrence of mishap. For if accident were predetermined, and therefore unpreventable, such provision and law would be senseless. . . ."

Similarly, the same evidence is obtained in the law put forth in the appointment of the six cities of refuge for the manslayer that kills any person through error, so that the avenger's hand cannot reach him before the slayer is brought to judgment. (Num. 35, 11-12 and Deut. 19, 5-6.) Had the slayer been destined to die and his day of death predetermined, such law for the prolongation of his life would have been useless and senseless. Maimonides quotes several more laws from the Bible (supported by the Talmud to drive home his point of legal, moral, and providential backing of preventive action) to prove that there is no predetermined date of death of an organism, biologically and otherwise.

The bio-physiological (physical) considerations may be taken up next. Great as Maimonides was as a thinker and philosopher, his mediaeval medicine was entirely pragmatic and therapeutic, leaning completely upon the teachings of his masters Hippocrates, Galen, and Avicenna. Nevertheless, we find in the Mishney Tora, section Hilkhot Deot, ch. 4, much of wise instruction for the prolongation of life that might be accepted even today as commonsense medicine. These physiobiological principles of life, though 'physical,' are fundamental and indispensable to life. They are enunciated clearly and succinctly, and each of them is accompanied by examples:

A 1.* Causes that disrupt the equilibrium of the innate heat from within. These may affect the organs of the warmth (brain, heart, liver), either because of poor mixture (too cold or too warm), or because of obstruction—thus not allowing the motivating force to reach the chest. Similarly, if the lung be blocked, then the air cannot reach the heart, thus the innate heat is extinguished. By the same token, the vessels of the liver may be blocked, the heat then cannot reach it. Thus death ensues in these instances.

2. The quality of the heat itself may be altered in three ways: either by increase, as in burning fever, or due to a pyrotogenic medication, such as euphorbium; or as a result of disease brought on by freezing, hemiplegia, or other cold diseases; or because of drinking of a cold medicine, as for example, opium or hemlock.

3. The influx of the mass of heat, or its withdrawal, may be too great. In the latter case, for instance, too much of any one of the four vital juices may be excreted, thus the implanted heat is put out; in the former, there is overstuffing with the principal juices and foods, both solid and liquid, so that there is no room for the free passage of inhaled air, and thus the heat is choked. This extinction of the innate heat may be compared with the vessels and ventricles of the brain in which case the innate heat goes out, and thus death immediately follows.

B. There are six causes influencing the innate heat from without:

1. It may be driven out of the body, as, for example, by great joy which overtakes a man all too suddenly. Thus the exterior and interior of the body are chilled and death takes place. This is in a way comparable to the fire of a lamp when a strong wind puts it out; also when the ventricles of the brain are reached and the substance of the heat is driven out; finally, also when its mass (i.e., the blood as the carrier of the innate heat) is driven out, as happens in the case of a wound, or a vein, or artery that has been severed, so that the blood completely escapes and the innate heat is extinguished. It may be compared then, by way of simile, to the lamp from which the oil has run out.

2. When the heat is brought back to the body, as when sudden fright or anxiety causes the natural warmth to penetrate suddenly into the interior

* Weil's enumeration.

of the body. This way, however, it is suppressed, and so it is extinguished, and consequently death suddenly takes place.

3. Overwhelming of the heat, as in the case of drowning, when the cavities of the body fill with water, the result being that breathing is impossible, the natural heat is thus choked and death intervenes. This may be compared to the smothering of the fire of the lamp by an excessive quantity of oil.

4. Inadequate respiration, when death ensues, because when a man chokes, the air is prevented from entering the lungs. Then the fuliginous waste products accumulate in the heart and thus the innate heat is extinguished. In this case, it is like a lamp covered by a heavy vessel, the smoke accumulates, and the light is put out.

5. Destruction of the substance of the innate heat, which may occur in two ways. Firstly, as the result of the inspiration of cold air mixed with harmful stinking gases, as in the case of emanations from cadavers or from sewers and drains, in which the black fetid mud of nauseating putrefaction is to be found. Thus is the substance of the innate heat destroyed. In this case one finds similarity to the light of the lamp which goes out because it has been placed in too much smoke, or in a place to which too many gases rise. Again, the substance may be destroyed by the sting or bite of a poisonous animal, spreading poison throughout the body.

6. The quality of the innate heat may be destroyed in two ways. First, by the person getting extremely overheated as the result of staying too long in the sunshine or in a hot bath, which is like putting a lamp in the sunlight, or near a hot fire. Secondly, in exposure to extreme cold, death results from the extinction of the innate heat.

C. Trauma causes death by severing the interconnected structure of the body. Care should therefore be taken to avoid accidents, and so ensure that one reaches the natural span of life.

After having given us the translation of the Responsum, paraphrased above, Weil goes on to comment on the text. Again, we shall consider briefly only the last part of his interesting and scholarly commentary: the physiological fundamentals of the medical proofs (pp. 42-48). One would readily realize, as Weil points out, that Maimonides in the Responsum has followed the Galenical tradition of the primordial elements, 'substantial moisture,' innate heat, etc., in accordance with the physiological theories of his time. And after having considered the old humoral physiology in detail, Weil goes on to dwell upon the three forms of spirits or Pneumas, viz., the natural, the vital, and the Pneuma of the Soul, as implied in the Responsum.

It is interesting to note in connection with the Pneuma and its variants that its ancient Hebrew homologue, or perhaps equivalent, seems to point to a similar, if not identical, conceptual structure, making it more universally prevalent in antiquity than merely confining it to Greece and its

sphere of intellectual influence. Thus in Hebrew, Pneuma had also three linguistic and conceptual forms: נשמה (neshama), נפש (nefesh), and רוח (ruach). These have been used loosely since time immemorial as synonyms, but if we turn to their classical ancient usage in the books of Moses, they at once assume a specific and classificational rôle. Thus, the first, neshama (from the root nashom–breathe) is found in Genesis 2, 7: ". . . and breathed into his nostrils the breath of life (nishmat hayim)"; which would correspond to the natural pneuma. The second, nefesh, is found in the second half of the very same sentence: "and man became a living soul (nefesh haya)." Still more clearly it is tersely stated in Leviticus 17, 11 and 14: "For the life (nefesh) of the flesh is in the blood." "For as to the life of all flesh the blood thereof is all one with the life (nefesh) thereof"; which would apply to the vital pneuma. The third, ruach, which has been used for wind as well as spirit both in its real as well as spiritual, dynamic, creative, and destructive sense, would correspond to the pneuma of the soul; thus we find: ". . . and the spirit (veruach) of God hovered (ruach) to pass over the earth," *Ibid,* 8, 1. "Not by might, nor by power, but by my spirit (beruchi), saith the Lord of hosts," Zechariah 4, 6.

Weil recapitulates briefly but basically the fundamental concepts of Hippocratic and Avicennic medicine as accepted by and reflected in Maimonides. He also cites Avicenna who, like Maimonides, discusses accidental and natural death. However, Weil points out that whereas Avicenna urges that ". . . It is the duty of Hygiene to allow the human body to reach that natural end of life which is called death. . . .," Maimonides seems to emphasize more poignantly the other end: the pathological, i.e., accidental death. He describes various cases of this type of death and shows that those accidents are in no wise necessitated or predetermined maladies. All of them can be avoided and proper preventive measures can be taken against them.

To sum up, short as this Responsum ascribed to Maimonides may be, we find in it evidence that Maimonides, though keeping to the traditional teachings of his day, exhibited the following modern basic concepts, albeit in vague and rudimentary form: The importance of environmental factors upon the physiological and even morphological determination, though recognizing hereditary factors and their limitations. Individual differences. Dynamic rather than static morphological fluidity of the organism and its components. Chemical composition of bodily make-up, oxidation, and combustion. Hormonal action and influence upon the body. Fluid balance and the principle of homeostasis. The concept of stress mechanism, where emotional, let alone physical, factors are capable of disturbing physiological homeostasis.

The Responsum attests to the systematic and clear thinking of its author, and also to the painstakingly thorough work and keen scholarship of Weil. It is fascinating how Maimonides sought to show not only the compatibility but also the harmony between mind and body. Just as in his

philosophy, so too in science he spiritualized matter and materialized the spirit. To him his Tora was "a tree of life," and its ordinances were meant for man so that "he shall live by them and not die by them (Yoma, 85)." Only by such philosophy can one be predisposed to conclude that health and longevity are not predetermined but that it is preventive measures that largely determine the life expectancy of man.

It is in this light only that one is not surprised to find in the very cautious and unpretentious person that Maimonides is known to have been, the following other challenging statement: "He who will guide himself in these ways that we have indicated, I guarantee him (ani arev lo) that he will not die and will not need a physician . . . unless his body was defective from its very beginning (Mishne Tora, Hilkhot Deot 20)." It seems that unless Maimonides intended to use a more than authoritative term for psychologic-therapeutic reasons solely, such guarantee could not easily be accepted as a scientific, fool-proof truth.

LEONARDO DA VINCI. *On the Human Body,* The anatomical, physiological and embryological drawings of Leonardo da Vinci with translations, emendations and a biographical introduction by Charles D. O'Malley and J. B. de C. M. Saunders. New York, Henry Schuman, Inc., 1952. 512 pp., 1200 drawings, $25.

Reviewed by BERN DIBNER, *scholar-industrialist whose Burndy Library, now at Norwalk, Connecticut, has issued many brochures in the history of science.*

THIS is the year of conjunction of two of the most impressive anniversaries in science and technology—the invention of printing from movable type and the birth of Leonardo da Vinci. To honor each of these events is in itself a primary reason for celebration; to fuse them into a single event, such as the publication of the above book, deserves the scientific world's fullest attention.

Gutenberg's gift to society has been recognized and studied for centuries. Leonardo, however, is a comparative newcomer to the world of science, a world he so brilliantly envisioned and a world to which he devoted so much of his time and interest. For 132 years after his death, Leonardo's name was a vague memory to a very few people. In 1651, his *Treatise on Painting* appeared, and therewith his precepts on art were absorbed by generation after generation of artists. His technological and anatomical works remained unknown until practically our own time.

To J. P. Richter goes the credit for presenting, in some semblance of adequacy, both text and drawings of Leonardo's scientific investigations. At the beginning of this century, there appeared three efforts at the publication of Leonardo's anatomical studies. First the Sabachnikoff *Anatomia, Fogli A* appeared, followed shortly by *Fogli B.* These fine folios, in limited editions

of only four hundred copies, for the first time showed the world of scholarship Leonardo's depth of interest in anatomy. Finally, the superb task of reproducing the drawings in faithful color was undertaken by Drs. Vangensten, Fonahn, and Hopstock, who issued from Christiania during 1911-16 the *Quaderni d'Anatomia* in six magnificent volumes, but in an edition of only two hundred and forty-eight copies. With such material now available, historians of anatomy and medicine, such as Charles Singer of London and J. P. McMurrich of Toronto, turned their experience and talents to the long-dormant contributions of Leonardo in anatomy and through their studies furthered the interest in Leonardo among students of the history of anatomy. The base of all of these studies still remained narrow because the issues appeared in such small numbers that comparatively few could guage the skill and scope of Leonardo's investigations. It therefore is to the great credit of Drs. O'Malley and Saunders and to Henry Schuman, the publisher, for having undertaken so great a task as freshly to translate, annotate, arrange chronologically, and publish one of the richest veins of knowledge and interest, the anatomical work of Leonardo.

Our heritage of Leonardo's drawings, of which over six hundred sheets have survived 450 years of handling, is in itself a measure of the reverence and appreciation in which they have been held. The exhibition of Leonardo's original drawings, borrowed from the Royal collection at Windsor and exhibited in the spring and summer of 1952, drew record crowds that queued up even in the rain in the yard of the Royal Academy. This attests to the general interest in both the drawings and subject-matter.

Difficult as it is to dissociate the great artistry of Leonardo's treatment of any subject—architectural, botanical, mechanical, or religious—from the subject-matter itself, the anatomist of today must determine on a professional level what Leonardo's contributions as an anatomist actually have been. Leonardo, earlier than Harvey, followed the precept to learn "not from books, but from bodies." The analyst of Leonardo's anatomical books must disregard the fact that his most intense labors were compressed mostly into the last dozen years of his life, in particular after the dissection of the centenarian in Florence sometime between 1504 and 1506. Leonardo must necessarily stand on his own record as an anatomist and as though he had no other interests. This record, in itself, is no small one. However, it remained for Drs. O'Malley and Saunders to subject every one of Leonardo's anatomical drawings and notes to the analysis of modern scholarship. Although to them Leonardo was not the innovator of the many discoveries claimed for him by lesser investigators, they still find it is possible "to perceive beneath the genius of his art the groping of his mind as it sought emancipation from a debased mediaeval Aristotelianism, through a corrupted Galenism to the achievement of a position of relative scientific independence." This was no easy attainment for an investigator contemporary with Columbus.

In the report of a visit by Antonio de Beatis to Leonardo at Cloux in 1517, we are informed that Leonardo claimed to have dissected thirty bodies. This number of dissections is questioned by the authors. They count at the most five references to bodies and members mentioned by Leonardo in his notes. There always remains the question of missing notes since the vicissitudes of Leonardo's papers now make them far from complete. Even the great collection at Windsor, rediscovered in 1778 and once counted as 779 drawings, consisted in the last century of only 600. What has been lost?

There is general agreement among historians of anatomy that Leonardo's work was a revolutionary step away from the traditional dependence on authority and towards direct personal investigation. That is why he is so often linked with Harvey and Gilbert as fathers of the experimental method in science. McMurrich said "Vesalius was undoubtedly the founder of modern anatomy—Leonardo was his forerunner, a St. John crying in the wilderness." Leonardo, who read Mundinus and Galen, necessarily accepted their interpretations where he could not directly contradict them. He missed the system of coronary circulation by accepting Galen's supposed flux and reflux in the heart through the sieve-like septum. Leonardo was, after all, a citizen in a world that did not know oxygen, and the microscope had nearly two centuries to wait to be invented. Yet he did manage to give us a truer representation of the structure of the heart, brain, and vascular system than anyone up to his day, and he represented them in a manner unmatched in any day. Although as an enrolled member in the Compagnia de'Pittori since 1472 he had the privilege of attending dissections performed by members of the guild of doctors and apothecaries, those opportunities were few, for there was no university in Florence after 1472 and dissections were not customary.

Whatever Leonardo's contributions were, they have now been made a matter of record for each investigator to examine for himself. This was made possible by the present authors, Charles D. O'Malley, Professor of History at Stanford University and director of the historical collection of the Lane Medical Library, and J. B. de C. M. Saunders, Professor of Anatomy at the University of California Medical School. Their earlier collaboration in the issue of notes on the Vesalian drawings has brought a sense of order into a field of considerable confusion; we await expectantly their translation for the first time in any modern language of the full text of the *Fabrica*. The difficulties of the task—working from Leonardo's notes, a knowledge of the state of the art in Leonardo's time, his own long and constantly changing viewpoint, and the necessity of dealing with nomenclature, part Arabic, part Latin, and much non-existent—must have been at times disheartening. However, it was accomplished, and there is much for which to be thankful. Unlike the previous studies, we are now given the advantage not only of a fresh translation but also of detailed notes and references that will be invaluable. The authors have arranged Leonardo's notes

and drawings in nine general systems: the osteological, myological, comparative anatomical, cardiovascular, nervous, respiratory, alimentary, genitourinary, and embryological. To link the author of such investigations with the creator of the Mona Lisa and the Last Supper seems fantastic.

Leonardo shared with other ambitious authors the dream of preparing an all-inclusive treatise on anatomy which, he noted in 1489, was to bear the title "On the Human Figure." This was to cover man's structure from the outer skin to every member and muscle. Leonardo left us a very clear outline of his plan: "This my depiction of the human body will be shown to you just as though you had a real man before you. . . . However, you must realize that such knowledge will not leave you satisfied on account of the very great confusion which results from the combination of membranes intermingled with veins, arteries, nerves, cords, muscles, bones, and the blood, which of itself stains every part the same color. . . . Therefore it is necessary to make further anatomies, three of which you will need to acquire a complete knowledge of the veins and arteries, destroying everything else with the utmost care; three others to acquire a knowledge of the membranes; three for the cords, muscles and ligaments; three for the bones and cartilages; and three for the anatomy of the bones which must be sawn through to demonstrate which are hollow and which are not, which are medullary, which are spongy, which are thick from without inwards, which are thin." For one so thorough as Leonardo this was too much, and the material was never organized beyond the initial plan. This leads us to the speculative thought of what might have happened if Leonardo had not been so thorough or ambitious. What engraver, even a van Calcar, could have prepared suitable plates? As it is, the confluence of the efforts of those who kept Leonardo's drawings from harm during 450 years, of Gutenberg who gave us printing, of Senefelder who gave us lithography, of O'Malley and Saunders, and finally of Henry Schuman has finally realized this ambition. The new edition of 5000 copies, in a format once dreamed of by Leonardo, is now available at a popular price (the Quaderni is valued at over $750). One more stone in the arch of the Renaissance has been set into place.

R. W. Johnstone. *William Smellie: The Master of British Mid-wifery.* Edinburgh and London, E. & S. Livingstone Ltd.; Baltimore, The Williams & Wilkins Co., 1952. viii + 139 pp. $4.00.

Reviewed by Lloyd G. Stevenson, *Associate Professor of Medical History and Literature, Faculty of Medicine, University of Western Ontario, London, Canada.*

The series of biographies of medical "greats" which Messrs. Livingstone are now producing is remarkably uniform in substance if not in size. They are all nicely printed and illustrated; they are pleasantly readable; they

contain, alas, little novelty, either of fact or idea. Some of the subjects, the darlings of British medicine, have been biographied to death. (This is not true of Smellie.) But the salient merit of these otherwise not very distinguished volumes is a real and solid one, which goes far to outweigh their faults: they are mostly the work of technical experts in the appropriate branches of medicine, and are mostly by their nature amenable to this approach, although technicalities are dealt with at a semi-popular level. The modern physician, surgeon, or chemist has no great advantage from professional capacity in dealing with such a figure as van Helmont; or at least the limits of his advantage are soon reached. Unless he can compensate for his "modern" viewpoint by broader cultural attainments—and most of all by historical insight—he is seriously handicapped because he thinks in the wrong terms. When we come to William Smellie or Astley Cooper, however, the case is altered. They belong, of course, to their respective times and must be sought for in their own groves and thickets; yet their times are nearer ours, their thought is nearer our own. This is not the only consideration. John Hunter is nearer to us by a generation than Smellie but is harder for us, as he was for his contemporaries, to understand. What he gave us must for the most part be described, as it exists today, in rather broad terms. Smellie's specific contributions to medicine, on the contrary, have not lost their outline in the flood of change; the mechanics of his craft, a department in which he so greatly excelled, have not got far beyond him. What most needs to be said about him can best be said by an obstetrician, preferably by a senior man of wide experience who clearly recalls a time when Caesarian section was not the easy answer that it is today. When, in addition, this senior obstetrician is a Professor-Emeritus of the University of Edinburgh, writes well, and knows what is meant by "pawky" and "weil tirlised," hero and biographer are well met.

Few complaints can be made of Professor Johnstone's biography. In a rather perfunctory opening chapter on "the setting of Smellie's life," we are instructed not only about the Scotland of his youth but about the London of his middle age. This is like displaying all the sets at once, before carrying off both furniture and flats to clear the stage for a play on bare boards. In other respects the arrangement is good. The five chapters in which the great *Treatise* and the *Anatomical Tables* are discussed fall naturally into place at the right moment in the narrative, and are followed also quite naturally, by an account of the attack made on Smellie by John Burton ("Dr. Slop"). The "Autobiographical Fragments" are the work of an old man summing up, and are properly reserved until the end. The only chapter which really breaks the narrative pattern is "Smellie's Obstetrical Instruments." This justifies itself as a special essay without undue recapitulation of events. It is true that the selection from Smellie's obstetrical case histories, many of which are vivid, personal anecdotes of practice, ranges from the beginning to the end of his career, because their arrangement in the second and third

volume of the *Treatise* is a matter of logic rather than of time sequence; but those which have particular biographical interest are chosen for use as needed, the rest are given in the chapters on the *Treatise* itself. In any case they produce somewhat the effect of conversation and could not have been rigidly time-bound.

The chapters on the *Treatise* are the best in the book. They have the great merit that they will send many readers to the original work. First-rate obstetrical adventures, together with *genre* pictures of the eighteenth century scene in the incomparable manner of Smellie *cum* Smollett, make lively reading. The commentary is excellent; it is authoritative yet modest, brief yet sufficient. Wise use is made, here and throughout, of Peter Camper's travel journal, which was not available sixty years ago when Professor Glaister wrote *Dr. William Smellie and his Contemporaries.* One would like to know how much postmortem work Smellie did. I think it would have been valuable also to discuss a little more fully how he arrived at his essential "discovery," that of the mechanism of normal labor. His position relative to other workers in this connection might have been made clearer by using the materials assembled by Ingerslev some forty-five years ago.[1] It is, however, reassuring to find Smellie's paramount contribution stressed, particularly because "Harvey Graham" has somehow contrived to omit it altogether in a recent ten-page account of Smellie.[2]

The background material on the history of obstetrics, and the final chapter on "Smellie's Greatness and Posthumous Fame" are generally adequate, limitations of space considered. They seem to be based largely (there is no list of references) on such authorities as von Siebold, Fasbender, and Spencer. Reputation and influence certainly go together but they are not quite the same thing; it would therefore be interesting to know how much of Smellie's teaching (apart from what he had to say on forceps) was actually abandoned during the period when his fame suffered partial eclipse. It would have been useful, further, to have said something specifically of the moral and social climate of British obstetrics in the eighteenth century. This theme is not avoided but neither is it sought out.

We are told that it was "found impracticable under present circumstances to reproduce a catalogue" of Smellie's library at Lanark. This omission has since been made good in an interesting paper by Dr. H. P. Tait and Dr. A. T. Wallace.[3]

[1] Ingerslev, E. "Beiträge zur Lehre von dem Geburtsmechanismus." *Arch. Gesch. Med.*, 1908, *2*, 141-188.

[2] Graham, Harvey. *Eternal Eve; the history of gynaecology and obstetrics.* New York, 1951. "Harvey Graham" is the pseudonym of Dr. Isaac Harvey Flack. Except for the fearful omission mentioned above, the passage on Smellie is very good.

[3] Tait, Haldane P. and Wallace, Archibald T. "Dr. William Smellie and his library at Lanark, Scotland." *Bull. Hist. Med.*, 1952, *26*, 403-421.

Nobel, the Man and His Prizes. By H. Schück, R. Sohlman [and others]. Edited by the Nobel Foundation. Norman, Oklahoma, University of Oklahoma Press, 1951. 620 pp., port. $6.00.

Reviewed by GEORGE ROSEN, *Professor and Head of the Department of Public Health Education, Columbia University, New York, New York.*

IN 1950, the Nobel Foundation celebrated its fiftieth anniversary. To commemorate this occasion the Board of the Foundation issued a volume containing an account of its establishment, as well as surveys of the achievements in the fields of physics, chemistry, medicine, literature, and in work for peace which have been honored with Nobel Prizes. Included are chapters on the life of Alfred Nobel and on the Foundation which bears his name. Separate chapters deal with the prizes in the various fields, and also with the administration and finances of the Foundation. There is a section on the statutes of the Foundation and the prize-awarding institutions, a complete list of the Nobel Prize winners, and an index. The authors of the separate sections are the chairmen of the committees responsible for the prizes in physics, chemistry, medicine, and physiology; the permanent secretary of the Swedish Academy and chairman of its Nobel Committee, who is responsible for the Prize in literature; and the director of the Norwegian Nobel Institute, who is responsible for the peace prize.

This is an authoritative volume and presents a complete view of the prizes. In addition, it offers a valuable historical survey of the highlights in the progress of medicine and physiology during the first half of the twentieth century.

JOHN F. FULTON. "André Vésale Fondateur de l'anatomie moderne," *Revue des Questions Scientifiques,* 1952, Sér. V, *13,* 161-170.

Reviewed by CHARLES D. O'MALLEY, *Professor of History, Stanford University, Stanford, California.*

THIS essay by the Titulaire de la Chaire Francqui in 1951, was delivered in Louvain as a concluding lecture and graceful tribute to one of the great sons of Belgium. The early years of the sixteenth century witnessed the blossoming of the trans-Alpine renaissance. The contemporaneous decline in Italy is symbolized by Leonardo's journey to France in 1516 and his death at Amboise in 1519, while the foundation of Busleyden's Collegium Trilingue in 1518 emphasizes not only the rise of the new northern humanism, but also its distinction from that of Italy.

Vesalius, born in 1514 and provided with an elementary education in Brussels, entered the University of Louvain and the Collegium Trilingue at some time in 1528-29 where he acquired a facility in Latin, some knowledge of Greek, and at least an introduction to Hebrew, as well as an interest in medical philology which remained with him throughout his career. It was also here that he made a number of friends, many of whom reappear from time to time as distinguished men in the course of Vesalius' life, as, for example, Gemma Frisius, who assisted in the celebrated theft of a body from

the gibbet outside Louvain in 1537; Anthony Perrenot, later Cardinal Granvelle and imperial chancellor, who succeeded in gaining an increased stipend for Vesalius as imperial physician; Andreas Masius, who wrote to the Abbot Gerwick in 1559 that he had been cured of a fever "by the mercy of God and the efforts of Vesalius"; or George Cassander to whom Joannes Metellus wrote in 1565 describing Vesalius' death on the island of Zante in the previous year. Dr. Fulton properly emphasizes Vesalius' formative years in Louvain at the Collegium Trilingue, calling attention to and employing the information which Henri de Vocht is making available about the University of Louvain in general and the Collegium Trilingue in particular.

Thereafter, the highlights of Vesalius' career are briefly sketched, with particular attention paid to the *Tabulae anatomicae* and the *Fabrica*. Unfortunately, through a typographical error the *Tabulae* are in one instance attributed to the year 1539. And it should perhaps be noted that, contrary to the statement in the colophon of the *Fabrica*, this work was not ready for distribution until 1 August 1543. Finally, this reviewer must question the statement "Il fait peu de doute que Çalcar a dessiné le frontispice de la Fabrica." These matters, however, in no way detract from the warmhearted and sincere appreciation of the great Belgium anatomist nor from the spirit in which the essay was written: "La flamme de la Renaissance ne s'est pas éteinte car, pendant les quelques mois que je viens de passer à Louvain, j'ai senti souffler dans cette Université l'esprit de Vésale et des grands humanistes et j'ai moi aussi subi cette influence merveilleuse."

K. E. Rothschuh. *Geschichte der Physiologie.* Berlin, Göttingen, Heidelberg, Springer-Verlag, 1953. xi + 249 pp., illus. $7.00.
Reviewed by Ilza Veith, *Assistant Professor of the History of Medicine, University of Chicago, Chicago, Illinois.*

Dr. K. E. Rothschuh's excellent history of physiology appears at a time that is significant for physiology in general and for American physiology in particular. At the present moment physiologists in this country have paused to take stock of their profession, their achievements and their aims, and are asking themselves: "Where are we going?" The American Physiological Society, under whose auspices a Survey of Physiological Science is being undertaken, is aware that such a question cannot be answered without first replying to the question: "Whence have we come?" Since Europe, and nineteenth century Germany in particular, are largely responsible for the present concept of physiology, the thorough study here reviewed is both timely and valuable.

Dr. Rothschuh, an associate professor at the Physiological Institute of the University of Münster, has long been concerned with the evolution of his field. He traces its history with complete competence from antiquity to the turn of the twentieth century, devoting to the nineteenth century almost two-thirds of his book. His preoccupation with German physiology is explained by the significance of German contributions to the subject, as well

as by the fact that writers of other national origins—for example, K. J. Franklin in England and John F. Fulton in the United States—have emphasized in their accounts the contributions of other countries.

The author's guiding motif is the evolution and transmission of physiological thought and the consequent changes in the concept behind the word "physiology." From its earliest meaning comprising the study of all nature, organic as well as inorganic, the word came to concern itself almost exclusively with the chemistry and physics of body functions. The personalities responsible for each change in concept are treated in some detail. Dr. Rothschuh completes this portion of his book with extremely valuable studies on the schools established by Johannes Müller, Carl Ludwig, Carl Voit, F. L. Goltz, and others. The "genealogical tables" demonstrating the physiological disciples of each of these men show the far-reaching influence of their teachings.

It is disappointing that this most recently published history of physiology does not attempt to evaluate the achievements of the twentieth century. In a very thoughtful final chapter, however, the author meets this anticipated reproach with some challenging facts and figures. Since the turn of the century, the number of physiologists attending international congresses has increased almost forty times; published material in all languages for each specialty within the field has grown to a total of almost 100,000 printed pages annually; methodology has become so sharply differentiated and defined that few physiologists, if any, are able to grasp the processes and results of all physiological subspecialties. Researchers have more and more tended to confine themselves to smaller areas of study, and with the increasing frequency of discoveries their names have flashed across the scientific sky and been quickly dimmed by the light of new luminaries. The result has been an inevitable duplication of work and prodigal expenditure of futile effort, side by side with astonishing progress along true paths. Any historical evaluation of the quality of the recent physiological output must await the cautious judgment of time. It is perhaps still possible to approach a study of physiological trends statistically, but the field as a whole has outgrown the framework of a narrative account.

Whether this development is desirable or not, whether it can or should be stemmed, should soon be determined by the Survey of Physiological Science and its Committee on History, which will undoubtedly take full cognizance of the mature judgments of this book.

It is interesting that Dr. Rothschuh's history of physiology, perhaps one of the last such studies to deal with the field as a whole, has appeared not as an independent medico-historical work, but as part of a physiological textbook.[1] Apparently, the study of physiology and its history have not yet become completely separate entities.

[1] *Lehrbuch der Physiologie in zusammenhaengenden Einzeldarstellungen . . . herausgegeben von Wilhelm Trendelenburg and Erich Schütz.* Berlin, Göttingen, Heidelberg, Springer Verlag, 1953.

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